



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

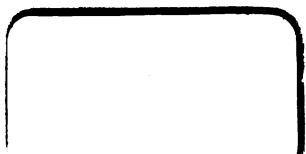
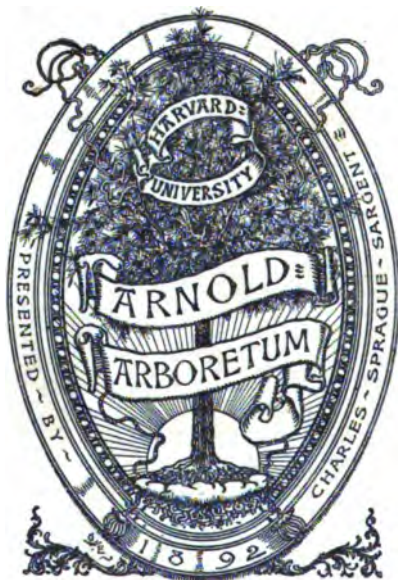
- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

BI
70

JL





#

QUARTERLY
Journal of Forestry.

VOL. I.

EDITED BY

A. C. FORBES and W. R. FISHER,

For the Royal English Arboricultural Society.

LONDON:

SIMPKIN, MARSHALL, HAMILTON, KENT & CO., LTD.

PRINTERS:

G. & J. COWAN, CARLISLE; and BRADBURY, AGNEW, & CO. LD.,
LONDON AND TONBRIDGE.

1907.

May 1908
18186

BRADBURY, AGNEW, & CO. LD., PRINTERS,
LONDON AND TONBRIDGE.

INDEX TO VOL. I.

	PAGE
Afforestation Congress in London	313, 373
ANDERSON, R. L., Conversion of Coppice into High Forest	219
Appointments, New	310
Arboretum de Tervueren	281
" des Barres	198
" of Tubney	165
ARCHIBALD, J., Effects of Larch Thinnings	76
Argyresthia Laevigatella	204, 316
BAYLIS, P., Obituary notice of	319
Beech, Life-history of	230
BENNETT, J. B., Timber Sales in Worcestershire	189
BEWICK, T., Notes from Staindrop	73
BOPPE, L., Obituary notice of	219
BOULGER, G. T., Life-history of Beech	230
BRANDIS, Sir D., Indian Trees	192
" " Obituary notice	219, 317
Creosoting timber	49, 350, 358
Deodar in the Himalayas	179
Devonshire: Tour in Woodlands	53, 60, 156
Economic Biology, Meeting at Cambridge	151
" " Journal of	282
ELWES, H. T., Notes on Trees in Devonshire	53
" Spring and Autumn Frosts	169
Exotic Forest Trees	88
FISHER, W. R., Notes on Tavistock	60
" Forest Protection	197
" Princes Coverts, Oxshott	19
" Lecture at Carpenters' Hall	207
FORBES, A. C., Larch Disease	38
" Root Rot in Scots Pine	32
FORBES, WM., Method of Raising Plants from Seed	8
Forestry, American Literature	7, 365, 367
" at Cirencester	151
" at Oxford	83
" Education	5, 85
" Exhibitions	314
" Government Action	81
Franche Compté et Belfort, Bulletin	148, 368
GILLANDERS, A. T., Forest Insects	27
Gloucestershire, Tour in Woodlands	308
GRENFELL, A. P., Sutton Park	338
HAVELOCK, W. B., Creosoting Wood	49, 350
" Financial Results in Yorkshire	214
" Sale of Oak Trees	217
" Timber Sale in Lincolnshire	316
" Witches Brooms	348
HENRY, A., Tour in Rocky Mountains, etc.	147
" Lecture in Oxford	211
HENRY, E., Preservation of Wood from Rot.	358

	PAGE
Honey-fungus on Cedar	216
HUFFML, Économie Forestière	369
Imperial Institute, Bulletin	282, 368
Indian Forester, reviewed	283, 363
Indian Trees	192
Insects, Destructive	204
Irish Forestry	307
" " Society	46, 204, 289
Isle of Man Plantations	213
KERR, J. S., Irish Forestry Society	46
Larch Disease	4, 38
" Insects	316, 204, 205
" Thinnings	76
Lime Tree, Fungus	315
Long-leaf Pine	365
MADLIN, Laws of Private Forests	280
MATHEY, Utilisation of Timber	360
MAYR, Dr. H., Exotic Forest Trees	88
Midland Reafforesting Association	150
MOIR, E. Mc. A. The Deodar	179
Nematus Erichsonii	67
Obituary Notices	218, 317, 319, 320
Osiers near Sion House	152
POPE, A., Use of Unemployed	22
PRATT, E. R., Quick Fences	221
" Salix alba	320
Princes' Coverts, Oxshott	19
RAMAIENGAR, B. V., Osiers	152
ROBERTSON, J. P., Derbyshire Notes	184
" " Home Timber Trade	182
" " Timber Sales	70
SCHLICH, W., Tavistock Woods	156
Scotch Experimental Area	307
Silviculture, International Congress of	79, 312
SMITH HILL, J., Nematus Erichsonii	67
" Notes from Aspatria	80
SOMERVILLE, W., Insect on Larch	204
Spring and Autumn Frosts	169
STORY, F., Chirk Experimental Station	15
Sutton Park	338
Tavistock Woods	60, 156
Timber Sales	70, 182, 184, 189, 214, 217, 316
Transactions of Irish Forestry Society	289
" Royal English Arboricultural Society	91
" Royal Scottish " "	146, 361
Trees of Great Britain and Ireland	90, 195, 354
Tubney Arboretum	165
Webster's Diary	90
Weymouth Pine	75
Willow Wood for Cricket Bats	322
Witches Brooms	348
WOOD, L., Lecture at Surveyors' Institution	143
" Sussex Forestry	77

CONTENTS.

INTRODUCTORY NOTE	Page 1
-------------------	-----------

CURRENT TOPICS:—

The Weather	4
The Timber Trade	4
Larch Disease	4
Forestry Education	5
Our Woodland Area	6
American Forestry Literature	7

ARTICLES ON FORESTRY:—

The Best Method of Raising Trees from Seed in the Home Nursery. By Wm. Forbes	8
Chirk Experimental Forestry Station. By Frazer Story	15
Princes Coverts, Oxshott, Surrey. By W. R. Fisher	19
Use of the Unemployed for Afforestation Work. By A. Pope	22
Practical Notes on a few Northumbrian Forest Insects. By A. T. Gillanders	27
Root Rot in Scotch Pine. By A. C. F.	32
The Larch Disease. By A. C. F. and R. Anderson	33
The Irish Forestry Society and its Work. By J. Scott Kerr	46
The Creosoting of Home-grown Timber. By W. B. Havelock	49
Notes on the Trees seen at Bicton, Killerton, Poltimore, and Powderham. By H. J. Elwes, F.R.S.	53
Silvicultural Notes on the Tavistock Woods. By W. R. Fisher	60

NOTES ON PRACTICAL FORESTRY:—

A Note on the Sawfly attacking Larch Disease in Cumberland (<i>Nematus Erichsonii</i>). By J. Smith Hill	-	-	67
Timber Sales and Timber Measurements. By James P. Robertson	-	-	70
Notes from Staindrop. By Thomas Bewick	-	-	73
"Pinus Strobus." By J.F.S.R.	-	-	75
The Effects of Different Thinnings on the Growth and Value of Young Larch Plantations. By J. Archibald	-	-	76
Forestry in East Sussex. By Lealie S. Wood	-	-	77
Third International Congress of Silviculture	-	-	79
Notes from Aspatia. By J. Smith Hill	-	-	80

REVIEWS AND EXTRACTS:—

British Forestry.—Action by the Government	-	-	81
Forestry at Oxford	-	-	83
The South African School of Forestry	-	-	85
"Exotic Forest and Park Trees for Europe"	-	-	88
"Trees of Great Britain and Ireland"	-	-	90
Webster's "Foresters' Diary"	-	-	90
Transactions of The Royal English Arboricultural Society	-	-	91
Statement of Accounts	-	-	120
List of Office-Bearers and Members	-	-	122



Photo]

ENDSLEIGH, 1906.

[R. G. Foster, Burford.

Quarterly Journal of Forestry.

No. I.]

JANUARY, 1907.

[Vol. I.]

Introductory Note.

THE appearance of this, the first number of a Quarterly Journal of Forestry, is chiefly due to the rapid growth of the Royal English Arboricultural Society, on the one hand, and the increasing interest taken in all matters relating to forestry, on the other. For over twenty years an annual volume of *Transactions* has been published by the Society, containing, in addition to the business proceedings, selected essays sent in for competition, reports of annual and local excursions, and other matters of importance which had occurred in connection with forestry or the Society during the previous years. For several years, this volume has been steadily increasing in size, and had attained dimensions which rendered it one of the most important annual publications connected with rural economy.

Recently, however, a strong feeling has been gaining ground that an annual publication is scarcely an adequate medium for disseminating the large amount of information amongst its members which come into the hands of the Society at frequent intervals. Events which occurred immediately after the publication of the *Transactions* could not be reported until a full year had elapsed, by which time interest in them had frequently been lost. Matters of general interest to foresters, especially

those relating to climatic phenomena, insect or fungoid pests, timber sales and various questions connected with silviculture in general, could not, for obvious reasons be discussed by the members of the Society in the pages of an annual volume. The only means of securing the advantages of speedy publication, and of bringing a large number of members into closer touch with current events and topics of mutual interest in home, colonial, and foreign forestry, was by the issuing of a monthly or quarterly Journal, which, in addition to the ordinary matter that would have found its way into the *Transactions*, would also possess the special features usually associated with a frequently published periodical.

The first definite steps towards the carrying out of this idea consisted in a small committee being appointed to consider the question, and which reported to the Council Meeting held at York on March 5th of last year. At that meeting it was decided that a sample number of such a Journal should be prepared, and presented to the members at the Annual Meeting to be held at Exeter in August. The Royal Scottish Arboricultural Society, and the Irish Forestry Society (of which the latter had courteously sent a delegate to the Council Meeting), had already been approached with a view to their co-operation in the publication of the proposed Journal, the idea being that it should be given as national a character as possible. The Royal Scottish Arboricultural Society declined to associate themselves with the movement, but decided to publish its own Proceedings twice a year, while the Irish Society cordially responded to the invitation, and consented to assist to the extent of officially recognizing the proposed Journal as applying to Irish as well as English Forestry, and by subscribing, *pro rata*, to the cost of its publication.

I was asked to prepare the sample number, and have it ready for presenting to the members at the Annual Meeting to be held at Exeter on August 15th. At that meeting the recommendation made by the Council that the Journal should be proceeded with was accepted, and arrangements made for issuing the sample number (which has since been revised and enlarged) as No. 1, to be followed by others at quarterly intervals.

Owing to my appointment under the Irish Department of Agriculture, I am unable to continue the work of editing future numbers, and the new arrangements for carrying on the work will be explained by Mr. W. R. Fisher, who has consented to act as Chief Editor, and to whom all communications should be addressed.

A. C. FORBES.

The Publication Committee of the *Quarterly Journal of Forestry* after the 1st January, 1907, will be as follows:—

Arboriculture—H. J. ELWES, F.R.S., Colesborne, Cheltenham ; A. HENRY, D.Sc., F.L.S., Royal Botanic Gardens, Kew.

Entomology.—A. T. GILLANDERS, F.E.S., Park Cottage, Alnwick.

Home Forestry.—W. B. HAVELOCK, The Nurseries, Brocklesby, Lincolnshire ; A. C. FORBES, F.H.A.S., Dept. of Agriculture, Dublin ; J. P. ROBERTSON, Edensor, Bakewell, Derbyshire.

Forest Education.—J. SMITH HILL, B.A., Principal, Agricultural College, Aspatria, Cumberland.

Irish Forestry.—A. E. MOERAN, Palmerston House, Portumna, Co. Galway.

Mycology.—M. C. POTTER, M.A., Professor of Botany, Armstrong College, Newcastle.

Foreign and Colonial Forestry and Chief Editor.—W. R. FISHER, M.A., 6 Linton Road, Oxford.

Advertisements and Exchange Column for Plants and Seeds. E. DAVIDSON, Assistant Secretary, R.E.A.S., Haydon Bridge, Northumberland.

Any papers intended for publication in this Journal may be sent either to the Chief Editor, or to one of the Sub-Editors.

W. R. FISHER.

Current Topics.

The Weather.—Although readers of a forestry journal usually know more about the weather than they wish, it is such a characteristic British institution that it would be unpatriotic not to mention it. So far as the North of England is concerned, the summer of 1906 has probably been one of the best for years. Sufficient heat and sufficient moisture, following a cold but not seriously frosty spring, have produced a growth on all forest trees which we should imagine to be above the average; while newly planted trees which failed to grow had to excuse themselves on other ground than a dry season. In the South, more frosty and droughty conditions prevailed, and for once in a way this part of the country has been less favored than the North. However, it is probably safe to say that while better seasons may have been seen, there have also been a great many worse, and taking things all round, the forester has no serious cause for complaint against the weather of 1906.

The Timber Trade.—With foreign imports competing with almost every branch of the home timber trade, it is scarcely possible to expect that prices can rise to any great extent for timber of ordinary quality. Improved conditions of trade in general, however, have resulted in prices of the last few years being maintained, and it is not at all likely that the future will see any decrease in them. What is wanted more urgently than anything is a steady supply of well grown timber to feed such industries as still remain to us, and cheap means of transit between the grower's wood and the consumer's yard. Until these conditions are obtained, really fair prices for home-grown timber will never be realized.

Larch Disease.—On another page will be found a short summary of the result of recent inquiries which have been made on this subject. In the meantime, young larch in a large number of plantations in the North of England is looking anything but well. Tops and ends of shoots are dying back, while the stems

in many cases are covered with adventitious shoots, which usually represent the tree's final effort to maintain its existence. That this is larch disease of a kind no one doubts; that it is the larch disease no one imagines, unless it be the student who has just read a text book on tree diseases, and gone out to look for some. Perhaps the real cause is a combination of unfavourable conditions of soil and climate, the result of which must culminate at some time or other in the death of the tree, and no good reason can be given why this culmination should not occur in the year 1906 as any other. In the particular cases to which we refer, it is fairly clear that the year 1905 was the one in which they were first noticed, and it is possible that something especially unfavourable in the year or two preceding may have been directly responsible. But of this more will be found elsewhere. The point to which it is desired to call attention is the fact that the failure of the larch as an individual, or as congregations of individuals is no sound reason for condemning the species, as has been the fashion for many years. The value of the tree for many purposes justifies a little risk being run in this respect, it is true, but it should be distinctly understood that risks of any kind mean failure or disaster in some cases. The existence of healthy larch plantations in most parts of the country, although less numerous than one could wish, are sufficient to prove that it still flourishes if given the proper conditions, and the natural instinct of the forester can often recognize these where cut and dried methods of diagnosis fail.

Forestry Education.—Whatever progress British Forestry may be making in other directions, it is certainly advancing in the provision of educational facilities. Almost every University College now has its forestry lecturer, one only differing from the other, let us hope, in his degree of excellence. The latest development is the appointment of Dr. Somerville to the Sibthorpeian Chair of Rural Economy at Oxford, where forest botany is to occupy his attention very largely. With Drs. Schlich and Somerville, and Professor Fisher, Oxford should turn out Indian and Colonial foresters without much difficulty, for doubtless the provision of the necessary demonstration area is only a matter of time. The influence of such a school of forestry upon many of

our future landowners should be great, for although few undergraduates may take up the study of the subject in dead earnest, they cannot fail to derive ideas which will be put into practice later on in the case of those succeeding to large estates, as many of them doubtless will.

In the smaller centres, much should be done for the coming land-agent and practical forester, for there can be no excuse for pleading ignorance of the subject after this. So far as the forester alone is concerned, the question of more importance than his education is that of affording him an opportunity of turning it to account after he has got it. Estates which employ a forester above the grade of working woodman are few and far between; and after all is said and done, there is as yet little inducement for an able-bodied youth of average intelligence to learn more than the routine which is followed on an average estate, and which is much the same, apart from minor details, as was followed a hundred years back. The chief changes which have taken place are probably in connection with saw-mill machinery, and a knowledge of mechanical engineering is almost, if not quite, as important a qualification for the young estate forester to possess as silviculture itself, while creosoting is also increasing in importance year by year.

Our Woodland Area.—According to the Agricultural Returns, the total area of woodlands in Great Britain now amounts to 2,768,243 acres, of which 1,715,473 acres are in England alone. Figures for the latter in 1895 were 1,665,741 acres, so that a nett increase of nearly 50,000 acres has taken place in ten years. This is at the rate of 5,000 acres annually, although the figures for planting alone indicate the average rate of planting to have been nearly 6,000 acres. Without knowing the class of land planted, or the type of plantation formed, it would be unsafe to argue that this increase is a sign of forestry development, although it cannot but be a step in the right direction.

In Scotland, on the other hand, a decrease of about 10,000 acres has taken place in the same period. How is this? Does it indicate clearing at a more rapid rate than replanting, or that landowners are turning their attention more to grouse and deer than the planting of waste land? The question is of importance

in more ways than one. In the first place, a retrograde movement in a country with immense areas of waste land is a serious matter in rural districts already depleted of their inhabitants to an undesirable extent. In the second place, it suggests that Scottish forestry is not all that it has long had the reputation of being. As the cradle of the British forester, as distinct from the woodward and wood-man of the South, and the birth-place of forestry education in its application to the British forester, this apparent decline should be carefully investigated, and when the Royal Scottish Arboricultural Society have completed their researches on the larch disease, they might well turn their attention to a matter which concerns not only their welfare as an institution, but possibly their survival as a professional society.

Although the connection between game preserving and forestry may not be the direct cause of this decline in planting activity, it is quite possible that the greater popularity of the South during the winter months, results in greater attention being paid to the increase and preservation of game preserves, and plantations for ornament and shelter in England generally; while Scotch estates form more attractive residences during the autumn, when grouse and red deer are to the fore. The planting of land on purely economic lines is still the exception rather than the rule, and on many Scottish estates once famed for the forestry they were able to exhibit, planting has now almost entirely ceased, or is confined to the replanting of cleared ground. At any rate, the cause of the decline should be ascertained without delay.

American Forestry Literature.—The various bulletins and pamphlets issued by the United States Division of Forestry are all directed towards educating the public in the elements of tree planting, and the management of small plantations attached to farms or small estates.

The importance of fostering a love in the individual citizen is clearly recognized, and every assistance which can be rendered him by the State is provided. These pamphlets as a rule are short and practical, and the writers seem actuated by a desire to impart useful information with as little unnecessarily dry packing, or the use of technical phraseology as possible. If anything, they

appear to err on the elementary side as regards illustrations, the Chiefs of the Division of Forestry evidently being no great patrons of Art, preferring to illustrate their publications with a simplicity resembling the style of the very ancient Briton, rather than the up-to-date American.

The rapid strides which the Americans are making in forestry may be seen in the enormous forest reserves, which now total up to the large area of 85,000,000 acres, and which is being gradually placed under systematic management.

Articles on Forestry.

THE BEST METHOD OF RAISING TREES FROM SEED IN THE HOME NURSERY.

Awarded Silver Medal.

IN an old cookery book, a recipe for making hare soup reads : "First catch your hare"; and for the purpose of growing trees from seed, with any prospect of success, the Home Nursery must be favourably situated and have a soil composed of a good loam, of a fair depth, and a dry, open sub-soil. The best aspect is south or south-west, the situation being fairly elevated, and as far removed from broad-leaved trees as possible. If a nursery is situated near broad-leaved trees, these trees form a favourite resting place for the cockchafer beetle, and there is sure to be trouble with the larvæ of this insect amongst the young seedlings in the nursery.

The first thing a forester does, is to decide upon the species of trees and shrubs he intends growing in the nursery, and for purely silvicultural purposes he will confine himself to the trees grown in this country ; and as far as possible the seeds will be collected from healthy trees grown upon the estate. The kinds of seeds generally collected on the estate are acorns (sessile and pedunculate), beech mast, ash and sycamore, alder, birch, elm, hawthorn, holly and hazel. It is seldom indeed that foresters collect the seeds of conifers, as the cost of gathering, and the interest on the expenditure for the erection and upkeep of a suitable plant for extracting the seeds from cones of the various coniferous trees,

and storing the same, would come to more than these seeds could be purchased for from a reliable firm of seed merchants ; besides, a full and regular crop of tree seeds cannot be depended upon in the same locality every year. We must bear in mind that there are many kinds of trees which only produce a crop of seeds once in every three or four years, some trees have longer intervals.

The table on next page indicates the best season of the year for collecting tree seeds ; but no hard and fast rule can be laid down for the collection of them, as the time of ripening varies with the seasons, and in different localities.

After the seeds are collected, they must be stored in most instances, and the storage of tree seeds is a most important matter, and unless proper facilities for storage are obtainable, the cost of collecting them is so much labour lost. All seeds—excepting those which require to be buried in sand—should be carefully dried in a cool, airy spot, before being stored away for the winter.

The best place for storing acorns, beech mast, and chestnuts, is in a cellar having a dry cement floor. Even here they must be examined occasionally to see that they are neither moulding nor drying. If they are moulded they should be carefully gone over, and the damaged seeds removed. On the other hand, if they shew signs of drying—which is easily detected by the shrivelled appearance of the outer shells—they should be covered at once with sacking and chaff thrown over it. Small seeds should be placed into wooden trays and put upon racks.

Ash keys, yew, hawthorn, holly, and all fleshy covered seeds, or any seeds which do not germinate the spring after they are collected, should be mixed with three or four times their bulk of sand, and buried in pits, at the same time care must be taken to prevent water lodging in these pits. After these seeds have lain about fourteen months in the pits, they should be examined, and if they shew the slightest indication of germinating, they should be sown at once. Frost does not injure any kind of seed, but is beneficial to the germination.

If it is thought necessary to test the germination of tree seeds this can be done most expeditiously and effectively in an artificial temperature, placing the seeds in shallow pans filled with moist sand, or on sand with powdered sphagnum moss on the surface. Count the seeds carefully, and sow them on the surface of the

sand, covering them lightly; or place them on the sphagnum moss and keep moistened until germination takes place. Large seeds, such as acorns, can be cut open and examined.

Name.	Time t		Depth to cover seed-lings.	Space in square for each seedling.	Kind of Storage.	Age of Plant to		Where found.
	Collect.	Sow.				Plant in Nursery lines.	Plant out in the Wood.	
Alder	Oct.	April	1 in.	3	Dry and cool	1-2 years	3 years	Indigenous
Ash	Oct. and Nov.	16 months after	2 in.	3	Bury in sand	2 years	3-4 years	do.
Beech	do.	April	1 in.	4	Dry and cool	do.	do.	do.
Birch	July	At once	1 in.	3	do.	1-2 years	2-3 years	do.
Elm	May	do.	1 in.	4	do.	do.	do.	do.
Hawthorn	Oct. and Nov.	16 months after	1 in.	3	Bury in sand	2 years	4 years	do.
Holly	do.	do.	1 in.	3	do.	do.	do.	do.
Hornbeam	do.	do.	1 in.	4	do.	do.	do.	do.
Horshoe Chestnut	do.	April	2 in.	6	Dry and cool	1-2 years	2-4 years	Europe
Spanish Chestnut	do.	do.	2 in.	6	do.	do.	do.	do.
Larch, Common	Nov.	April-May	1 in.	2	do.	do.	3-4 years	do.
Larch, Japanese	do.	do.	1 in.	2	Dry and cool	do.	do.	Japan
Oak, Sessile	Oct. and Nov.	April	1 in.	4	do.	do.	do.	Indigenous
Oak, pedunculata	do.	do.	1 in.	4	do.	do.	do.	do.
Plane, London	do.	do.	1 in.	6	do.	do.	do.	do.
Scotch fir	Nov. and Dec.	May	1 in.	2	Dry and cool	2 years	do.	Europe
Spruce	do.	do.	1 in.	2	do.	do.	do.	Indigenous
Silver fir	do.	do.	1 in.	1 1/2	do.	do.	4 years	do.
Black Austrian pine	do.	do.	1 in.	1 1/2	do.	do.	5 years	do.
Coracian pine	do.	do.	1 in.	2	do.	3 years	4 years	do.
Weymouth pine	Aug.	do.	1 in.	2	do.	2 years	do.	do.
Sycamore	Oct.	do.	1 in.	2	do.	every year	do.	do.
Poplar	July	April	1 in.	2	do.	2 years	do.	N. America
Willows	do.	At once	1 in.	4	do.	1-2 years	3-4 years	Europe
Yew	do.	do.	1 in.	3	do.	do.	do.	do.
Douglas fir	Oct. and Nov.	16 months after	1 in.	2	Bury in sand	3 years	5 years	Indigenous
Sitka spruce	do.	May	1 in.	2	Dry and cool	2 years	3-4 years	America
C. Lawsoniana	do.	do.	1 in.	2	do.	do.	do.	do.
Red Juniper	Sept.	do.	1 in.	1	do.	do.	4-5 years	do.
Walnut	Sept. to Nov.	2nd May after	1 in.	1	Bury in sand	do.	3-4 years	do.
Hemlock	Sept. and Oct.	do.	2 in.	6	do.	1-2 years	do.	Europe
Sweet Birch	do.	May	1 in.	2	Dry and cool	2 years	4-5 years	America
(Betula lenta)	do.	do.	1 in.	2	do.	1-2 years	3-4 years	do.

Some seeds soon lose their germinating power. The seed of elm, birch, poplar, and willow, lose their vitality in a few weeks. Pines and spruces retain their vitality for one or two years after being taken out of the cones, but if they are left in the cones they retain their germinating powers for four or five years.

Seeds having a thin seed coat will germinate sooner than those which have a strong seed covering, as the soil moisture acts upon them more quickly; a pine or spruce seed taking a much shorter time to germinate in than a holly or hawthorn.

The seed-beds should be made about four feet wide, having alleys at least fifteen inches wide between them; when the alleys are narrow, the workers, in weeding the beds, often break the edges of the seed-beds with their feet, so an alley eighteen inches wide is better. Having previously prepared the soil by digging, measure out the width of the bed by placing a garden-line on either side of it, and throw the soil from the alley between it and the next seed-bed on its surface, reduce it to a fine tilth with the rake, and if you are going to sow hawthorn or holly on it, use the "cuffing-board," and draw off about half-an-inch of soil into the alleys on either side of the bed, then sow the seed broadcast—along with the sand—as evenly as possible, covering it carefully with the soil drawn into the alleys, and beating the whole surface smooth with the back of the spade.

Acorns, beech mast, chestnuts, etc., should be sown in rows across the bed, as there is more danger of injuring the young tender shoots during weeding operations if seeds of this character are sown in rows parallel to the alley, as in reaching over to the centre of the bed, the shoots are sure to get damaged. These seeds require to be more deeply covered, so drills of the required depth should be made with the triangular hoe. Some men use a straight-edge or line, and measure out the distance between each row with mathematical precision, but any man who is up to the work does it equally well, and in the quarter of the time taken by the man who trifles with a straight-edge.

Expensive tree seeds such as Sitka spruce, Japanese larch, Douglas fir, etc., should always be sown in rows across the bed, for the purpose of economising the seed. The best plan to adopt in doing this is to get a board seven inches wide, and nail two strips of wood half an-inch-wide, by a quarter-of-an-inch deep,

on to it, two inches from either edge. Place the laths so that they make depressions a quarter-of-an-inch deep, by half-an-inch wide on the surface of the seed-bed. Either edge of the board can be placed in line with the edge of the last depression, and the rows are made two inches apart; sow the seed carefully in these drills, and cover with fine soil. The board suits two purposes, it ensures uniformity in the depth and width of the rows.

Scotch pine, spruce, larch, etc., can either be sown broadcast or in rows, the rows economise seed, and are easier kept free from weeds, and if the forester can find time to sow them in rows, it will repay the extra trouble by the ease in weeding later on.

The seed and seedlings must be protected against the depredations of birds, either by netting over the beds, or coating the seed with red lead before it is sown.

Pheasants are very fond of acorns and beech mast, and although they are dressed with red lead, some of them will scratch off the outer shell, and destroy the cotyledons.

On the whole, netting is the best and most effective protection against birds. The greatest objection to netting is that it keeps the beds at a lower temperature than they would be during the day if it was not there, and this at a time when heat is most required. Mice also do a lot of damage to seed in the seed-bed, so they must be destroyed either by trapping or poisoning, or both.

"Damping-off" is caused by too thick sowing, or by excessive humidity during the early stages of the seedling's growth. There is hardly any cure for it, but when seedlings are noticed to come up too thickly, they should be thinned out to a normal stand. Nothing can be done with the seedlings so taken out, but it must be remembered that when seedlings are grown too closely together that they become heated, and then they seldom grow into serviceable plants; and one robust plant is better than half-a-dozen weaklings, which they would all be if they were not thinned in time.

The disease, *Phytophthora omnivora*, often attacks beech seedlings, and as soon as it is observed, pull up and burn every affected tree, and apply a dressing of hot dry sand amongst the rest of the seedlings. Thick sowing induces this disease, and it is

aggravated when the ground is badly drained. Prevention is better than cure in a case of this sort, so avoid thick sowing, and keep the ground clear of weeds at all times.

In transplanting seedlings from the seed-beds into the nursery lines, no absolute time can be fixed, as some seasons seedlings make three times the growth which they do in others. We have seen a seedling oak with a tap-root $21\frac{1}{2}$ inches long, and the stem was only eight inches high. Some nurserymen advise allowing oaks to remain in the seed-beds for three years before transferring them into the nursery lines. This is a mistake, for when any tree is lifted with a long bare tap-root, after this rude check to their growth, they cannot be expected to make much progress for some years after being transplanted. In the seed-bed any seedling has the tap-root much longer than the stem, and the proper time to remove them is before the tap-root gets too deeply fixed in the soil, and becomes bare of fibrous roots. Trees in a permanent position cannot have too strong a tap-root, and if this is destroyed in the infancy of the seedling, it never fairly recovers. If seedlings have made good progress during the first year, they should be placed in nursery lines the second, and allowed to remain there for two years previous to being planted out permanently. What every planter wants is stout short stems, with plenty of root fibre. For planting amongst brackens or any rough rank herbage of a similar nature, larger plants must be used, but they should not be allowed to attain the necessary height at the expense of having indifferent roots, and to retain the balance between the stem and the root, these trees must be transplanted again. Should there not be time to do this, some nurserymen put a man on either side of the line of trees (that ought to be transplanted) with a sharp spade each and cut the roots, at the same time raising the trees and treading them in again.

It may be remarked, that if men cannot be obtained to perform the necessary work in the home nursery at the proper time, that is, when it requires to be done, all attempts to establish a nursery should be abandoned; for to be successful in raising trees from seed every attention must be paid to them. Nursery work cannot

be put off on any consideration, for it cannot be caught up after the plants are once neglected. Far better not to have a nursery at all than to have a neglected one. It is bad enough to meet with failures, for no matter how carefully the various species of forest seeds are sown, it does not always follow that we are sure of a crop. At the time of sowing everything seems to favour the operation—the soil in the best tilth and the weather good—but the climatic conditions in this country are so variable, that they are generally the principal cause of failure in the forest seedling crop.

The best time for sowing coniferous forest seeds is from the middle of April to the middle of May, and we often have mild weather in April, which changes at once from being dry and warm, to cold and wet; and this may, with alternate frosts, continue long enough to cause the seeds to rot before germinating. May sowings, again, are liable to suffer from drought, or want of moisture in the soil, and recourse must be had to artificial watering—always a costly piece of work. For protection against failures of this kind, foresters might arrange to exchange seedlings with each other, because on one place there might be a plentitude of seedlings of a kind which the other might be short of, and *vice versa*.

Park and avenue trees require to be often transplanted and pruned in the nursery before they are fitted to occupy the positions they are intended for, and considerable attention requires to be given to them in order to provide good specimens. Every time they are transplanted all damaged roots should be removed with a sharp knife, for if they are planted with barked roots, they soon develop "root-rot."

The forester is sometimes asked to provide a tree to plant as a memento of some family event, and to produce a tree which can be planted out at any season of the year. For this purpose a few trees of various kinds should be grown in pots and plunged into the soil, and these can be depended upon to continue growing, no matter when they are planted out.

Do not expect to produce forest trees cheaper in the home nursery than they can be purchased in a sale nursery. The advantages of a home nursery are many, but this is not always one of them. The principal advantages are: (1) the plants are

grown under the best conditions, and have excellently formed roots and stems; (2) they are ready to move into the forest as required, and can be planted the same day on which they have been lifted in the nursery. Sometimes forest trees are a week on the way between the sale nursery and their destination, and may arrive during a frost, and this is greatly against them. They often have badly formed roots, owing to careless transplanting in the lines; this ought never to be in home-raised trees from seed.

The secret of success in any nursery work is to do it thoroughly well, or leave it severely alone; there must be no half measures, and everything must be done at the proper time. Never propagate any kind of tree from a cutting which can be produced from seed; the former is only an artificial method of prolonging the life of a branch; the latter is the natural way of growing a tree.

WM. FORBES.

CHIRK EXPERIMENTAL FORESTRY STATION.

THE arguments brought forward in favour of systematic experiments by the Departmental Forestry Committee (1902) so forcibly appealed to Mr. John Mahler of Penissa Glyn, that he determined to give effect to at least one of the proposals, viz., the establishment of "example plots." He gave facilities for this by most liberally making a free gift of fifty acres of land to be devoted to forestry investigation. It was part of Mr. Mahler's scheme that the ground should be under permanent and corporate control. This has been rendered possible by the Denbighshire County Council accepting the gift and offering to plant the ground under direction from the Forestry Department of the University College of North Wales.

The educative value of such a station is self-evident, and it may, therefore, be not unsuitable to give some description of the proposed experiments. It is proposed that there be ultimately about thirty-five different experiment plots exclusive of shelter-belts, which are being planted on the exposed margins. The standard size of the plots has been taken as one-and-a-quarter acres—the area suggested by Professor Somerville. As far as possible, the plots are of rectangular shape, and are kept separate and distinct from each other by paths nine feet in width. A road or ride down

the centre of the ground is twenty-one feet wide, and this connects with a public lane which extends round a considerable part of the area. These dividing lines will not only make it easy for those who visit the ground to find their way about it, but they should also facilitate the removal of felled stems, and particularly the early thinnings.

The ground to be planted occupies the upper portion of one of the rounded hills so common in Denbighshire and the surrounding counties. The vegetation consists of patches of gorse, alternating with grass and occasional bushes of blackberry and briar. The elevation varies from 900 to fully 1,200 feet above sea level. To some it may appear rather venturesome to attempt to demonstrate profitable forestry at such an altitude, but to those who have carefully examined the ground the effort seems to be by no means hopeless. The conditions other than the elevation are distinctly favourable: the land slopes towards the north-east for the most part, and, though the highest portion is undoubtedly much exposed, still it does not include the crest of the hill, which has been fenced off from the planting area. The soil, which is of a friable nature, is very suitable for the purpose in view. It shows little variation in consistency in the different parts of the site, it is at least of moderate depth, and the shivered rock (Silurian shale) which lies below is easily penetrated and able to afford good roothold for trees.

As to the species of trees to be used, the shelter-belts will consist principally of Austrian pine, Corsican pine, Mountain pine, Silver fir, Scots pine, sycamore and ash, with some spruce to the inner side. These will be planted not closer than six feet apart, and will be allowed to branch freely. Next to nothing is expected from them in the way of timber, the sole aim being that they form a protective screen to check the sweep of the prevailing winds. As regards the plots themselves, it is proposed to plant the lowest and most sheltered parts with the following species, associated as given below:—

Sycamore, beech and oak; ash and beech; larch and beech; Douglas fir (Oregon variety); Douglas fir (Colorado variety); Douglas fir and common larch; Douglas fir and Japanese larch; larch and sycamore; pure larch; Sitka (Menzies) spruce and common spruce; pure Japanese larch; American arbor vitae.

In the middle of the area will be the following plots:—

Scots pine and larch (in one case the larch will be removed when still young, and in another it will be retained); spruce and silver fir; Scots pine, Japanese larch and common spruce; Corsican pine, Japanese larch and Sitka spruce; Scots pine, spruce and larch (tried in various ways as, for example, pit-planted, notch-planted, seeds sown, widely planted and severely thinned).

The highest ground is reserved for:—Corsican pine, Scots pine (pure and in mixture with spruce and silver fir); Tyrolese larch; Scotch larch; spruce. Some odd corners will be planted with a few of the exotic silver firs, such as *Abies concolor*, *A. grandis*, and *A. nobilis*, while *Picea Omorica* and a few others may find a place. Anything like an arboretum is not aimed at, however, but rather a plain test of the forest trees grown upon commercial lines. Our main object is to discover the relative usefulness of the trees for timber production on a class of semi-waste land very common in Wales.

In justification of selecting the species which have been chosen some brief explanation may be made. Only two of the plots are wholly given over to broad-leaved trees, as it seems to be obvious that the soil and situation are better adapted for the growth of conifers; while, moreover, the latter as a rule reach maturity at an earlier age, and their timber (as seen from statistics of our imports) is much more largely used. To proceed with the conifers, European larch is respectively associated with beech, sycamore and Douglas fir. These should make interesting tests as providing examples of light demanding with shade-bearing species, and it may be that these will contrast favourably with the larch in the unmixed plots. It is the experience of many, that beech is the best associate for larch, but it is possible that on high situations, especially when lime is absent, sycamore may do equally well. As for the Douglas fir along with larch, the former will probably soon outgrow the larch, which will then disappear naturally or be removed in the early thinnings.

Some foresters hold that the Colorado Douglas fir is hardier and better adapted for hill-planting than the variety from Oregon, while others are prepared to deny this. As the two forms will be grown side by side at Chirk, and will receive exactly similar treatment, fairly conclusive results should be obtained as regards the

merits of each. There is also a difference of opinion in respect to the value of the Sitka or Menzies spruce (*Picea sitchensis*) for forestry purposes, but from the high reputation which it has gained in recent years in Germany and Belgium, its inclusion among the experiments is warranted. It will possibly outstrip the common spruce in rate of growth, but it is doubtful if it will overtake the Corsican pine and Japanese larch with which it will also be tried. Norway spruce and silver fir should do well together as they have so many characteristics in common, and in view of the great demand for "white deal," the plots of pure spruce are not out of place. In fact it may be that this tree will prove one of the most profitable under the given conditions. The intention is to grow it on separate plots for pitwood and for timber of larger dimensions.

Larch from Continental seed will be planted next to larch from seed collected in the Duke of Atholl's Perthshire woods, when it is hoped that their comparative disease-resisting qualities (if there be any difference) will be manifested. Larch canker is decidedly prevalent in the neighbourhood of Chirk, so that though the soil and situation seem to be most suitable for the tree's growth, the fell disease may yet spread to the area. Consideration has been given to this possible contingency, and in the case of unmixed larch, should the trees become badly infected, a severe thinning will be made, and the remaining trees will be underplanted with suitable shade-bearing species. In the plots where larch is planted along with Scots pine, spruce, etc., it is hoped that even though the fungus proves destructive there will still be something left. In any case such mixtures being very commonly adopted, require to be placed on trial. Scots pine and Corsican pine will both be tested, pure and in mixture, with other species, while, as already mentioned, some of the more important exotic conifers will be experimented with on a small scale.

The rates of increment of all these trees will be observed and recorded, and all peculiarities of their growth duly noted. Several methods of planting and of soil preparation will be tried, and later on there will be opportunity for thinning in several different ways.

On these matters it is intended that reports be issued periodically. It would assist us if others who are conducting experiments would communicate their results or acquaint us with the nature and progress of their work.

FRAZER STORY.

PRINCES COVERTS, OXSHOTT, SURREY.

THIS area of about 868 acres, is situate chiefly on the London Clay, but at its south-west corner there is a hill of Bagshot Sand. Some of the clay in the higher parts of the coverts is also covered with washings of sand, which render it less stiff than in places more remote from the Bagshot sand. The whole area is fairly flat, except to the south and west, from which the land slopes down towards the north and east. There are two lines of railways within a distance of one-and-a-half miles, and excellent roads through the wood, so that transport is easy.

The woodland, as it now exists, consists of some small plantations, an area of waste-land, and two farms, all of which were enclosed, in 1829, by the Duke of Coburg, husband of Princess Charlotte, and afterwards King of the Belgians. The plantations and waste-land contained oak standards and an underwood chiefly of white and black thorn, the latter predominating on the heavy clay. The Duke sowed the farms with acorns, and much underwood, chiefly thorns and birch, grew up among the oaks. The estate was purchased by the Crown in 1860, and most of the old oaks on it were then felled and sold to cover part of the purchase-money. The standard oaks now standing over the underwood have sprung up, either from the Duke's sowings or from acorns naturally sown by the old oaks.

The whole wood is now divided into four working-sections under coppice with-standards, the rotation of the underwood being ten years. As some of the land has been converted into building sites, about eighty acres of underwood are cut annually in four felling-areas of twenty years each. Until a proper working-plan is made of the wood, a more precise statement of the annual felling-area cannot be given.

For the last twenty years or more, ash, hazel, and sweet chestnut plants, three years old, are planted in the place of thorns and other inferior underwood that is cut out at each felling, about 20,000 of these plants being planted annually, so that the stock of underwood is steadily improving in density and quality. The eighty acres of underwood are sold annually by public auction, prices last year ranging from £6 to £8 per acre. The underwood is sold in small lots of one or two acres, and the purchasers clear

the area completely of all underwood, including the thorns, and make it up into saleable material such as props for fruit trees, crate wood, stakes for hedges, clothes-props, bean-sticks, pea-sticks, faggots and birch brushwood used for brooms, and especially for topping steeple-chase hurdles; birch for the latter purpose being, apparently, in considerable demand. There is a ready sale of all these classes of material. The underwood must be cut by the 1st March, made up by 1st April, and removed from the felling areas by the 1st May. A fine of 10/- is levied on the purchasers of underwood for any oak sapling that may be cut. The standards that are growing badly, or are considered large enough for sale, are then marked and measured by the woodman, and are readily sold at the following fixed prices:—

Up to 10 cubic feet	...	1/6 per cubic foot.
10 to 20 cubic feet	...	2/- per cubic foot.
Over 20 cubic feet	...	2/6 per cubic foot.

The top, lop and bark are given with the timber to cover cost of felling, and the standards are felled by the purchaser. The wood cutters are paid by the latter at the rate of £1 10s. per ton of bark delivered at the tannery (the merchant paying for the carriage of the bark) about ten miles from the coverts. The price of the bark is about £3 10s. a ton when delivered at the tannery, so that the merchant gets his timber felled, barked and ready for transport, with a small profit as well, on the sale of the bark. It is estimated that 120 cubic feet of timber yield one ton of bark, and the quantity of bark the wood-cutters can strip in a day depends greatly on the weather, as if the latter be warm and moist, the bark comes off easily, and the reverse if there be cold nights and dry weather; in the latter case, also, it is necessary to tap the bark with the butt-end of the axe before stripping, and this causes a loss of tannin, and depreciates the quality of the bark.

In the autumn, after a felling, all dead stools among the underwood are replaced by planting ash, hazel or chestnut, according to the nature of the soil, and all thorns that have been cut are similarly replaced by such plants to form valuable underwood.

Nature is looked to for regeneration of the standards, and there are generally a fair number of oak saplings, but this is never the case among chestnut underwood, which in ten years attains a

height of about thirty feet. The girths, at chest height, of the oaks average as follows:—

1 rotation	...	...	8 inches
2 "	...	...	1 foot 3 inches
3 "	...	...	2 feet
4 "	...	...	3 feet
5 rotation	...	...	4 feet
6 "	...	...	4 feet 9 inches.

I have visited this wood every year since 1891, and give the following measurements and prices of felled oak standards, which have been measured by my pupils in my own presence, the annual rings on the stumps having been carefully counted.

Age.	Girth at centre of bole.	Length of bole.	Volume in cubic feet. Qr.-girth.	Sale-price in shillings.
52	34 inches	20 feet	10	15s.
57	32 "	17 "	7½	10s.
60	33 "	18 "	9	12s.
60	40 "	21 "	15	22s.
60	40 "	26 "	16	24s.
60	54 "	24 "	31	77s.
64	40 "	22 "	15½	31s.
68	38 "	15 "	16	32s.
70	44 "	26 "	22	55s.
70	45 "	35 "	24	60s.
70	67 "	25 "	56	140s.
70	42 "	25 "	14	28s.
70	46 "	27 "	27	67s.
72	44 "	28 "	23	58s.
75	56 "	15 "	20	40s.
75	48 "	24 "	24	60s.
75	48 "	25 "	27	67s.
80	51 "	32 "	36	90s.
80	39 "	31 "	22	55s.
80	46 "	31 "	28	70s.
95	65 "	16 "	30	75s.
110	80 "	14 "	37	92s.

There is an excellent nursery on sandy soil, on ground sloping towards the north-east, and in it hazel, ash and sweet chestnut plants are raised. The hazel and ash yearling plants are purchased at 6/- per thousand, and lined out in the nursery, where they remain for two seasons' growth. Chestnuts are bought at 6/- per

bushel and sown, the plants—3,000 per bushel of nuts—are similarly lined out for two seasons. About thirty loads of farmyard manure are put on the nursery annually, and on to plots from which the older plants are removed for planting in the forest.

Rabbits are carefully kept down, and the woods are in a flourishing condition, though on the stiffest clay soils standards are a failure. They grow quickest on the sand, where trees seventy-five years old attain girths up to sixty-eight inches at chest-height, and marketable boles thirty-five feet long. The best timber, however, is produced on clayey loam, of which most of the area is composed.

This wood affords an excellent instructive plot for students, as it is managed on a continuous plan, and the quality of the underwood, and consequently of the standards, are steadily improving. Even on the clay that is too stiff for standards, excellent underwood is produced, and aspen and ash grow well.

It would improve the wood greatly for instructive purposes, were a proper working-plan made, and the working-sections and compartments numbered on the ground and shewn on a map. Some pruning of the standards is also advisable, and wherever natural regeneration of oak fails, some strong oak saplings should be planted on the felling areas. It is, however, the only coppice-with-standards that I know of easily accessible from London, that is managed on a continuous plan, and the good effects of this continuity of management are seen in the excellent prices obtained for the standards, while the prices of underwood will also improve as the thorns make way for good material.

W. R. FISHER.

USE OF THE UNEMPLOYED FOR AFFORESTATION WORK.

THE afforestation of waste lands, and the provision of relief work for the unemployed, are two problems which have been much discussed of late. The former has always had great interest for foresters, and the latter has gained interest by being considered in relation to the former.

Many people, particularly those who know little about either subject, think the two problems admit of one solution, and advocate

the employment of the "out of works" in planting, and while theorists have written largely on the subject, but little work has been done. The conclusions of most people are generally based upon ignorance both of the men to be relieved, and of the work to be done. In most cases they naively assume that the men are ordinary labourers genuinely anxious to find work, and that planting can be done as well by unskilled as by skilled workmen. Practical experience contradicts both these assumptions, and convinces one that "the submerged" are a very distinct class, often not wanting work, and usually hopelessly incapable of doing a job well when they get it, unless every motion is watched and guided, while the work of planting, as every forester knows, demands something very different from the unskilled labour which alone can be obtained from the unemployed. In all our large towns work of some kind has to be found for the unemployed in winter, and distress committees have to relieve in some way large numbers of men totally unskilled in the use of any tool. Their difficulties can only be completely overcome by finding some kind of work which can be done by unskilled men without costly tools, which can be carried on in any weather, and taken up and dropped as the number of necessitous labourers varies. The work should also pay for itself, or make but a very small charge upon the rates. This accommodating occupation, it is safe to say, cannot be found; even digging requires a certain degree of expertness if it is to be done well and cheaply. Afforestation can only rarely be undertaken as relief work, and even then with less chance of success than when skilled and intelligent men are employed, and several conditions prevent planting from even approximating to the ideal employment. In the first place, a large area of suitable land is needed, as any part planted will not again provide relief work for many years. Then, too, the work is not independent of the weather, and a very considerable degree of skill is required before planting operations can be carried out at all satisfactorily. The only point in favour of the idea is that planting is done in winter, when the unemployed are most numerous.

The experiment of making planting a kind of relief work has been tried on a large estate in the north of England during the past winter, and the experiences of the writer may be interesting.

The area to be planted consisted of moorland and poor pasture

very suitable for afforestation, in a very thinly populated district, eighteen miles from a large town. The owners having decided to form plantations, with the view of growing timber for commercial purposes, and wishing also to find relief for large numbers of unemployed, decided to try and work the two together, by sending the "out of works" to do the planting. With the estate lying eighteen miles from town, and situated in a very out of the way part of the country, it is obvious that the men could not travel to and from home night and morning. Wooden barracks were therefore erected, with accommodation for fifty men, in which they lived, being catered for by a hut keeper at a fixed charge per week.

Work was commenced in October last, and continued all through the winter, thirty to forty men being employed the whole time. They were of all trades—iron workers, bricklayers, painters, tramway men, etc., and a few jobbing gardeners. Very few were skilled in the use of a spade, and to many the tool was altogether strange. Only picked men were sent, those who appeared to be able and willing to work. They may be taken, therefore, as being above the average of the unemployed in our large towns, but as representatives of a class they were not a bright sample. Some few were out of work from misfortune, and these were the best, as when trade is slack, it is the worst men who have to go. The majority were undesirable in every way: the cast off of society, they were neither physically nor mentally capable of much exertion.

They took a great deal of teaching, constant watchfulness was necessary to get the work properly done, and it was a very difficult matter to make the men understand and do what was required. They took no interest whatever in the work, and did not particularly want to learn. It was only a temporary job, a peculiar form of charity to keep them from starving; they could not look upon it as their ordinary occupation and do it with diligence and care. Besides, what was the use of learning; they might be back in the town again very shortly!

By the time the men were accustomed to the work, and becoming expert, the majority left. Some few good workmen—perhaps half a dozen—went back to their own trades when opportunity offered. Most of the remainder grew tired of country life in winter, and returned to the town, while fresh workmen were

constantly being put on, and had to be broken in. There was no end to the training of novices. The gardeners at least, one would think, ought to make good planters, but they were little above the average. They may have been experts in planting flowers and ornamental shrubs, but planting forest trees on a large scale they knew nothing about. The ordinary raw workman can be taught quite as easily as a man with preconceived ideas. By constant care and close supervision, the planting decided upon was done, and done well, but I need hardly say the cost was much greater than it would have been with a skilled permanent staff.

Most of the men seemed to be very miserable and felt the cold very much, and being unused to the work, they did not like it. They had none of the pleasures of town, nor excitement of any kind, and no music halls to go to in the evenings. They were separated from their families, and though they went home from Saturday to Monday, the day in town rather unsettled than contented them. The life would have been a fairly pleasant one to countrymen—to men born and bred in towns the change was too great. The thought of Saturday, with pay, and the return home, was the only thing that kept them alive. Separation from families was of course unavoidable. Land suitable for afforestation nearly always lies at a considerable distance from towns, and the casual's family cannot be transplanted with him on account of lack of accommodation—even if no other objection existed.

The wages paid were $5\frac{1}{2}$ d. per hour, and nine to ten hours per day were worked. The married men had their homes to keep up in town, board and lodging in the country to pay for, and railway fares to and from town at week ends, and probably little would remain for their families when the men reached home. The wage was more than the work was worth, but not too much to maintain the men and their families and it must be considered as a combination of wages and relief allowance. Some of the men openly stated they would be better off doing three days' relief work in the town, and picking up whatever else they could. This might be something considerable, as people are usually generous enough to men out of work in hard weather, and casuals would rather rely upon charity than work.

Twelve men worked all through the winter. The rest of the thirty or forty were in a continual flux, coming and going the whole

time the work continued. A man who had thrown down his tools was not put on again. No one was treated harshly, but strictness was necessary; and it was impossible to overlook or pardon wilful misbehaviour, and hope to carry on the work. The language of the "no goods" was often amusing. They expressed their views very clearly and forcibly, and with a nice choice of adjectives. Some considered the Corporation of the town were bound to find them relief work of some sort and return them to their families when they wished to quit work. They, as ratepayers, were the masters; all those placed over them to superintend were paid with their money, and were consequently their servants. Those that held these views most strongly made but a short stay in the country, as the sense of their own dignity was too great to allow them to toil under the direction of their own servants. Many did not want work, and either had to be sent off or weeded out by piecework. Some, when put to piecework, threatened dire vengeance if at any time they met the foreman in town, and they apparently thought they had been sent out for a holiday. A large number, when made to work, contracted some illness, apparently peculiar to country life, said they did not feel well and must return to the town for medical advice. None of these men returned to work.

The cost of all the work—fencing, pitting, planting, etc., was very high, not altogether because the remaining men would not work, but because the tools and work were both strange to them, and they could not do nearly so much as a skilled man would.

In our opinion, afforestation of waste-lands cannot possibly be made to pay if such casual labour is employed. The cost of forming and managing plantations on poor lands must be kept to the lowest possible figure to secure a balance on the right side of the sheet, and this can only be done by employing men accustomed to the work. Besides the extra cost of planting, it is necessary to consider the way the work is done. Despite unremitting watchfulness and care, casuals' work can never equal that of experts. The plantations suffer as well as the pockets of the planter.

The only way in which any casuals can be satisfactorily employed in afforestation is, we think, to carefully select good men, country-bred if possible, who have drifted into the towns, and who

are *really* willing to *work* and face the conditions of country life in winter, and to keep these men at such rough work that inexpertness will tell only upon the quantity done, and not affect the future of the plantation in any way. The most intelligent might be mixed with the skilled permanent staff, and eventually, perhaps, might learn to plant properly; but usually, before a man has been at work long enough for that, he begins to hanker for the town, throws up his job, and again joins the ranks of the great army of unemployed.

A. POPE.

PRACTICAL NOTES ON A FEW NORTHUMBRIAN FOREST INSECTS.

TO the student of forest entomology who is anxious to get a collection of insects injurious to forest trees, Northumberland as a county is not a very happy hunting ground. This remark, however, applies more to the beginner than the trained entomologist, inasmuch as many species are represented, but not so numerically strong as to be considered as pests. But while the absence of insects may be deplored by the entomologist, it is greatly to the advantage of the practical forester, as it simply shews that the trees are generally very healthy, for sickness and uncongenial environments to the tree are great advantages to the insects.

In dealing with insects under the limits of a very short article, it is impossible to do more than just give one or two species from each group.

First, then, with regard to the mites, or *Eriophyinae*. Every husbandman is only too conversant with the "Currant Bud Mite," and perhaps a few of the allied species on trees. Now, as a county, Northumberland is all but immune from the "Currant Bud Mite." I have only found it once in the southern side of the county, and that in an old cottage garden.

The few public nurseries in the county are quite free from it. At the same time, it is worthy of remark that two species living in buds, viz., *Eriophyes avellana* on hazel, and *Eriophyes psilaspis* on yew, are very common. Those two species may be often found alongside gardens with fine crops of black currants, which are

perfectly immune. Thus it shews that that species which would, from the nature of their injuries, appear identical to the practical man, but distinct to the discriminating entomologist, are still further specifically separated by the fastidious tastes of the creatures themselves. One species, which is rare throughout the country, is fairly common in some parts of the county, viz., *Eriophyes fraxini* on ash. The injuries inflicted by the mite on the inflorescence give rise to malformations of the fruit, and thus where the damage is found, the injured fruit may be seen clinging to the tree, more especially during the winter season.

With regard to beetles, it may be said that beetles can be divided into two great classes, viz., beetles in general, and "bark" beetles—the "Borkenkäfer" of the German.

As regards the former, the worst species we have in the county, and one which, unfortunately, is very common, is the *Hylobius abietis* or pine weevil. From an entomological point of view, it is very closely allied to the genus *Pissodes*, and it is therefore well to state that the chief generic difference is that in *Hylobius* the antennæ are inserted on the rostrum near its apex, while in *Pissodes* the antennæ are inserted about the middle of the rostrum.

The pine weevil is injurious in the perfect state alone, chiefly to young coniferous trees from four to seven years old. Older coniferous trees do not suffer so severely, but they have been known to attack young hard woods, more especially when mixed with coniferous trees. In this part of the country, the plants mostly used for planting are about three or four years old, and when such are attacked after being recently planted, it is obvious the plants are not strong enough to resist injuries, and the consequence is that many die off, and expensive replanting has to be adopted. The pine weevil has a very interesting life history, and may be found in all its respective stages throughout the year. The eggs are deposited in the bark of roots or stools, which have been felled for two or three years. There is a difference of opinion amongst entomologists as to how long they live in the larval stage, but the perfect beetles generally appear about June and July. As this is a very destructive beetle, it would be well that as far as practicable, the insect should be kept in check.

We must, therefore, either deal with the perfect insect or larvæ. As regards checking the perfect insect, I have found them always

attracted in considerable numbers to the fresh sawdust at a movable sawmill worked in the woods, and in the same situation, I have also collected them in large numbers on the newly cut rails and posts, which were being sawn from recently felled timber. Hence it would be well to use fresh sawdust, and recently cut green coniferous timber as traps. Those arrangements could be examined every morning, and the beetles collected in a jar containing paraffin.

As regards dealing with the pest in the larval stage, it may be said that bad forestry is often the cause of much damage in this respect. It often happens that coniferous woods are cut down, and replanted with coniferous trees almost immediately after cutting. This practice is simply playing into the hands of the pest. On the other hand, a better method is to cut down the timber as low as possible, and when burning off the branches and rubbish (which should be done during the winter following the fall) it should be arranged that as many fires as possible be made on the old stumps, and this to some extent would check the breeding grounds. In addition to this it is generally asserted, that a rest should be given solely for the sake of keeping this beetle in check. This is only partly true. A rest of three or five years should be given to check the beetle *and improve the land*. It is well known to every planter, that land previously planted with pure Scotch fir, is not in a very fit state to replant as soon as the crop is cut; and to leave it rough and idle for a few years, generally makes matters worse. Hence it is well to graze it with stock and sheep for a few years. This has the effect of killing off the rough heather, and so loosening the bark from the roots as to greatly check the breeding ground for the beetles. Thus by pasturage we check this direful insect pest, improve the land, replant it much more cheaply, and get very much better results. Of course it may be objected that this method entails fencing, but a very cheap fence can be erected, and after grazing, the fence comes in for placing wire-netting upon.

As an example of bark beetles, perhaps the most destructive species is the pine bark beetle, *Hylurgus piniperda*. The life history is so well known that it cannot here be repeated, but as regards preventive and remedial measures, a word or two may not be out of place.

Though this is certainly a very destructive insect, yet in the

absence of special damage by gales, it can be held in check by fairly good management. This consists largely in destroying the breeding places, which it must be remembered are either in the stem of cut trees, or in sickly standing trees. Much, of course, will depend on the felling season, and in the interval elapsing before manufacturing. If, say, the trees were cut in September, and manufactured by March, no evil effects would accrue; but if the trees were cut in March, and not cut up at the sawmills until September, it would be entirely to the advantage of the beetle. Hence, if cut during the latter period, various checks should be adopted. For instance, the bark might be partially cut off, as in chipping the "four sides" of the log, which would have the effect of so drying up the bark, or otherwise separating it from the log to such an extent that the necessary conditions for propagation would be very much destroyed. If, however, the logs are not thus dealt with, then they should be barked at the sawmill from June to August, and all bark burned. Thus many larvæ and beetles would be destroyed.

If, on the other hand, we wish to lessen the breeding places in standing trees, all sickly trees should be removed. But while the latter may be recommended on entomological grounds, we should bear in mind that pure woods of Scotch fir should never be heavily thinned, but on the contrary, an unbroken canopy should always be maintained. Another measure for eradication may be adopted in felling certain trees, as catch or trap trees, and then burning the bark of the same.

From a practical point of view it may be well asserted that the barking referred to would not pay, but having regard to the damage accruing from the perfect beetle to the shoots of young trees, or where a nursery with young Scotch firs is in the neighbourhood, it might be quite advisable to check the pest in this way. It often happens that young Scotch fir plants in the nursery are injured by the beetle.

The small tops and branches of Scotch fir, lying on the ground, are not suitable for the breeding purposes of this species, though they are used for other beetles. The larger branches, however, may be used for breeding purposes, and it is therefore advisable, both for checking the beetles and for the health of the crop, to keep woods entirely free from dead trees and all brushwood.

Hence it may be seen that so far as the health of the woods is concerned, it is not a good practice to leave the dead branches on the ground for cover.

As regards "Scale insects," the various species are not at all plentiful. The common "Ash bark Scale," *Chionaspis salicis*, does considerable damage on ash in some of the younger woods.

The whole family depend entirely on the microscope for the essential points of the discrimination of genera and species. Even for general field work it is necessary to have recourse to a strong pocket lens. As regards the naked eye or pocket lens characters, a cursory examination shews that two forms of scale appear on the stems, the male form, which is very white and linear in form, and the female form, which is more or less pear-shaped. Sometimes we find both forms on the same tree; at other times only one form is found. In those cases, where the male form preponderates a whitish appearance is presented, and where the females are more in evidence, the bark is rough and scurvy looking.

The life history is very interesting. If we lift one of those female scales in mid-winter, turn it over, and examine it with a pocket lens, a number of beautiful red eggs will be noticed, together with the dead female. The larvæ from those eggs hatch out about the middle of May, and would probably measure about the one-hundredth of an inch in length. They possess six legs comparatively long antennæ, two eyes, and two very long transparent hairs at the posterior end.

The larvæ move about very actively for a few days, and then settle down to work, which is to suck the juices of the tree, through the bark. As soon as the larvæ assume this habit, they enlarge considerably—the legs are apparently lost, and the antennæ become less conspicuous.

After the larvæ has grown for a short time it casts its skin, and it is after the first larval moult that the sexes are determined. The males appear about the middle of July, and the female is fully developed by the end of August.

About the beginning or middle of September, the female commences to deposit her eggs, and as the eggs are deposited, the body gradually shrivels until finally it occupies but a very small portion at the top end. After egg deposition she dies, and as

remarked, the dead body of the female may be found together with the eggs throughout the winter.

As regards remedial measures for this pest, it is obvious that insecticides cannot very well be applied. A little observation will show that, as a rule, the insects generally attack trees from six to fifteen years of age; more especially unhealthy trees grown in fairly open spaces. As a general rule, it therefore becomes a question of good silviculture, and perhaps the best way is, if it can be carried out, to fill in with comparatively small healthy ash trees after the more hardy species are well advanced. If, however, they are not doing well, say in three or four years after planting, they may, in the entire absence of rabbits, be cut down very low, and allowed to grow up from a strong single shoot. With plenty of shelter this gives a very healthy young tree generally immune from "Scale." On suitable soil all young natural seedlings which appear in young plantations should also be encouraged, as they generally do well. Though at the same time, even amongst natural seedlings, where we do find isolated cases of Scale they are certainly very bad indeed. In early years the ash has very tender bark, and it is, therefore, essential that every endeavour should be made to protect it while young, as shelter and good growth are the best antidotes against the "Ash bark Scale."

A. T. GILLANDERS.

ROOT ROT IN SCOTCH PINE.

ATTENTION was recently called to the frequency with which young Scotch pine plantations become thin and patchy about the thirtieth year of their growth. The observations of Forstmeister Frombling on this subject are summarised in the Journal of the Board of Agriculture, and the suggestion was made that Scotch pine should not be planted on strong loamy or clayey soils, or on lands which had recently been cultivated for farm crops.

Herr Frombling's theory is that the rapid growth of Scotch pine on old arable land during the first twenty or thirty years is the result of the fertile and porous condition of the surface soil, and although accompanied by greater vigour during that period, is followed by the dying off of numbers of trees which on ordinary

forest land would probably have lived and developed into timber trees. This dying off is supposed to result from the disease resisting powers of the trees being weakened by the abundant supply of plant food in the soil, which produces a soft and sappy growth. When once this supply of food falls off, and the growth of the trees decreases, they fall a more easy prey to parasitic fungi, of which the worst in this case is *Trametes radiciperda*, the root rot fungus of most conifers and a number of hardwoods. Herr Frombling thinks it possible that the virulence of the fungus may be increased by the remains of animal manure still existing in the ground, and this, in conjunction with the weakened powers of resistance of the trees, goes a long way towards accounting for the abnormal number of deaths.

It is interesting to note, however, that as far back as 1892, this dying off of Scotch pine was discussed in the same journal (*Zeitschrift für Forst und Jagdwesen*) by Forstmeister Runnebaum of Eberswalde. The latter's theory was that the existence of a layer of more or less impervious clay or strong loam a few inches or feet below the surface was usually the cause of the failure of the pines. The points of the tap root and stronger side roots penetrated this layer for a short distance, their vitality became weakened by the lack of aeration, and they gradually died off, affording a means of entrance for the root fungus, which gradually effected the death of the trees. Even where the root fungus was absent or failed to gain an entrance, the death of the side roots produced a patch of resin-impregnated wood near the bottom of the tree which interfered with the circulation of sap, and gradually cut off the connection between the stem and root system. Figs. 1 and 2 are reproduced from Herr Runnebaum's article, and illustrate the effects, to which he attributes a great deal of the trouble.

A third theory with regard to this evil is one greatly favoured by Mr. Embleton of Dipton Wood, near Hexham, and a district forester under Mr. Gillanders of Alnwick. Mr. Embleton believes that the twisting and bending to which the roots of Scotch pine, in common with other trees, are subjected in the nursery, is largely responsible for the dying off of the trees when they reach the first stage of their existence. This twisting, as is well-known, does not affect the growth of the tree for a few years. Fresh roots are produced at or above the bend, and the

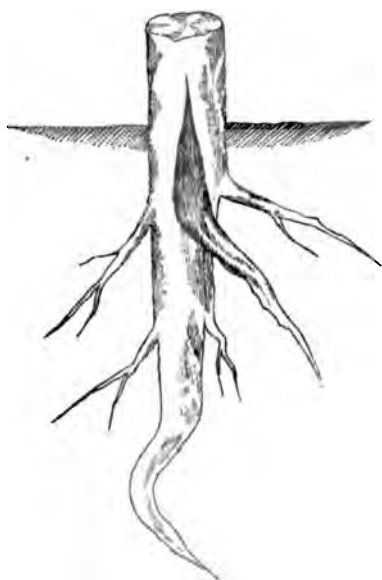


Fig. 1.



Fig. 2.

root system of the tree apparently returns to its normal condition. But the tap root, and frequently two or three of the secondary roots which were bent or twisted in the nursery, gradually increase in size, and this increase means that the roots which were formerly simply existing in unnaturally close contact with one another, now became welded together into a compact and solid mass. The cambium layers of the roots on their inner sides are subjected at first to great pressure, the growth of the layers is reduced to a minimum, and eventually ceases altogether by mere mechanical resistance to its increase. This is followed by the gradual impregnation of that part of the root with resin, and the latter prevents any ascent of crude sap taking place to the wood above it, while the return of elaborated sap, or plant food, in the context of the root is equally obstructed by the death of the latter. In this way a mass of dead or non-conducting tissue is formed at what, under normal conditions, should constitute the main artery of the ascending sap current. The result of this is obvious. In the first place, the crown of the tree is deprived of its proper supply of sap,

the root pressure decreases, and the needles and shoots become stunted and shortened. The latter, in their turn, elaborate less plant food, and the roots in their turn suffer in consequence, and in this way the death of the tree follows as a natural consequence.

Such is Mr. Embleton's theory, and it has much in its favour. As is fairly well-known, but not always realized, the pines have practically no power of throwing out adventitious roots above the "collar," or point at which stem and root meet. When the unnatural bend is made, not in the root, but in the stem itself, as often happens with deep nursery planting, and the twisting of the roots below also occurs, the condition of the tree is still worse. The swaying of the plant by wind, which is counteracted by the natural development of the roots under normal conditions, is, in the case of such a tree, the cause of almost fatal injury. The constant friction and pressure against the surface of the ground checks the growth of the stem immediately above the "collar," and in stony ground causes wounds and dead patches of bark which only heal up when the tree finally becomes stable. But even then the galls or "callus" of these healed wounds obstruct the normal ascent and descent of sap for a number of years, and such a tree is less likely to develop a healthy and vigorous root system than one growing under natural conditions.

In either of such cases, causes exist which are probably sufficient to account for the diminished vitality of the tree, and although it is not probable that every tree which has been maltreated in the nursery lines must of necessity die before it reaches maturity, there is good reason to suppose that a number of the worst examples fail to reach timber size. This was clearly shown by a number of Scotch pine roots extracted by Mr. Embleton, and which belonged to trees which had died out in the manner referred to. These particular trees were growing on land which had previously been cultivated, and the subsoil being of a clayey nature, there may be reasons for attributing their failure to one or the other of the German theories. But while German foresters trace this disease entirely to the influence of soil, and assert that it is equally as common in crops which have been raised directly from seed, as in those planted in the ordinary way, Mr. Embleton inclines to the belief that the

trouble is as prevalent on one class of soil as another, and can point to examples in support of his views. ;

When authorities differ on such points as these, the safest plan for the average individual is to add together the various theories and opinions and split the difference. There is no reason to suppose that all Scotch pines in young plantations die from the same cause, and it is only reasonable to suppose that one death may be due to soil, another to root twisting, and a third to something else. In connection with this subject, however, it is interesting to note the method Nature adopts in dealing with roots which are unable to extend further into the soil for any reason. On the root system of a blown down Scotch pine, previously growing on poor sandstone rubble, a number of root stumps were noticed which evidently formed portions of roots which had attempted to descend, but had met with large stones, or impenetrable substances in their descent. On cutting through one of these stumps, the formation of the root was found to have been as shown in Fig 3. This illustrates very clearly that the roots of the pine do not necessarily die when their growth in length ceases, as is generally assumed to be the case. When the surroundings are healthy, and conducive to continued existence in one form or another, the same process takes place at the end of a root which is unable to advance, as in the case of a dead branch, and an attempt is made to "occlude" or cover over the dead portion, and in this way prevent further decay or the entrance of parasitic organisms. In the case of the root in question, however, the process can hardly be compared to the healing over of an ordinary stem wound, as it took place at the end of a root several feet in length, and above which, so far as could be seen, no other roots branched off for a considerable distance. There was no apparent primary object, therefore, in plant food being expended in the long process of occlusion, as the entire root was taking no part in the economy of the root system, and could only be regarded in the same light as a pensioner or sleeping partner in comparison with the roots around it.

The above illustration is probably merely a rather pronounced

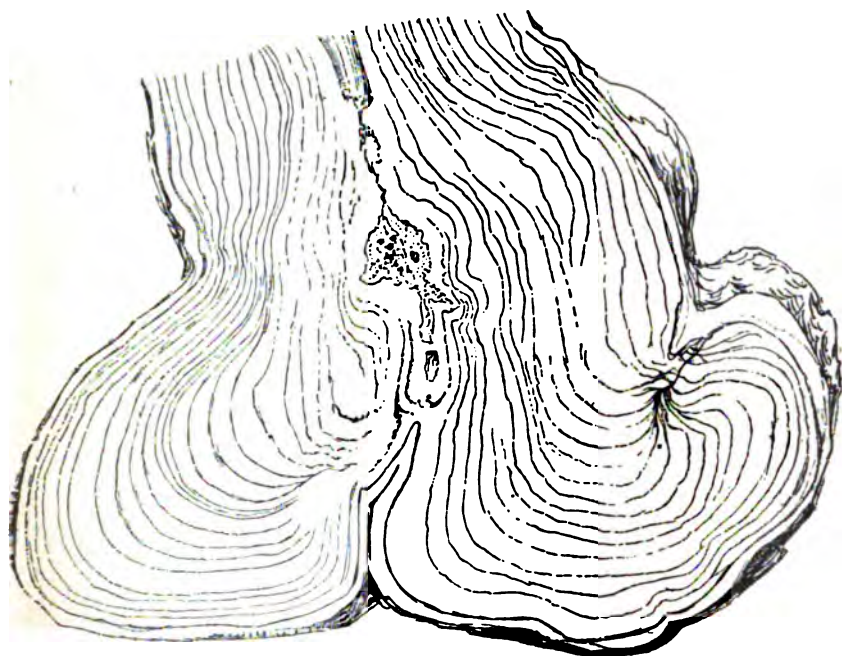


FIG. 3. . Natural Size.

form of what takes place in the roots of all trees which are growing under healthy conditions. But it is also suggestive of what occurs in wet or waterlogged soils, or wherever the surroundings of the root are not conducive to functional activity. In place of speedy occlusion of dead root ends, and the prevention of the living part of the root becoming infected with organisms which are probably merely saprophytic to begin with, we have conditions which are particularly favourable to such a fungus as *Trametes radiciperda*, or others of that nature. Portions of dead roots are infected with such organisms, and the latter gradually push their way to the boundary between the dead and living portion. In place of meeting there a barrier of cork, or impervious mass of heartwood, according to the age and portion of the root section presented to them, they find material which affords them an easy path from tissue that is totally dead to that only existing with a

great effort, and the saprophyte becomes, to all intents and purposes, a parasite.

In all such cases, the probabilities of root rot, or any other disease of that nature, are greatly increased, and it is easily seen how difficult it becomes to associate an event which is common to every organism in existence at all stages of its development, viz., death, with one particular or definite cause which at the best has but an obscure origin. So far as the particular disease which affects Scotch pine is concerned, it is quite possible that it simply acts more quickly in the case of that species than with others, and is consequently more easily noticed. But this is merely a suggestion, and is rendered rather unlikely by the fact that the trees usually attacked are often those which were previously strong and vigorous.

A.C.F.

THE LARCH DISEASE.

WHEN the Royal Scottish Arboricultural Society announced its intention of appointing a special committee to investigate the larch disease, the hopes of foresters throughout the country were raised, in the belief that something fresh would be discovered concerning this fell pest. So far, the preliminary report of this committee has alone been published, and it may be presumed that the real investigations are progressing, and that we shall hear more about them later on. But one may almost be pardoned for inquiring why this committee went to a great deal of trouble, and possibly some expense, in making enquiries upon the existence of what are commonly accepted as well-known facts. Out of the twenty-eight questions sent out by the committee, the answers to at least three-fourths are so obvious, and so certain to be of an inconclusive nature, that the members of the committee might almost as well have answered them themselves, and furthered the enquiry quite as much as when these answers were received from those to whom they were sent. The sum and substance of the preliminary report, at any rate, is that one-half of the observers are of one opinion, and one-half of the opposite, and that practically we know as much about the disease to-day as we knew twenty years ago.

As far as the occurrence of larch disease goes, it might well be compared to cancer or phthisis amongst the human species. Given favourable conditions, and the necessary host plants or animals as the case may be, the one is just as likely to occur as the other, and the reasons for its existence are just as easy or difficult to account for. In both cases the existence of a germ or spore is taken for granted in an outbreak of the disease. The fact of the spore gaining a footing upon the host in one case, but not in another is a point which no one can satisfactorily explain. It is easy enough to advance theories about the constitutional vigour, or temporary state of health of the host; but these do not convince one who takes the trouble to study individual instances, which first support one theory and then another with bewildering frequency. What seems clear is the fact that atmospheric conditions may exist which favour the spread of disease on one hand, while certain conditions favourable for furthering its attack upon the host may exist on the other. How far each of these conditions are individually responsible in producing the final result, it is impossible to say, and for all practical purposes is seldom of much consequence unless the causes can be removed by artificial agency.

As far as climate and larch disease go, it is remarkable to find that the disease is often less prevalent under climatic conditions which might be expected to favour its occurrence. For instance, Mr. Anderson refers below to the appearance of disease at Cirencester after wet summers and mild winters. Yet in many parts of Ireland, where these conditions are more or less normal, the larch is remarkably free from disease. The Lake District of Cumberland is another instance of a tract of country characterised by similar climatic features, and producing remarkably fine larch, although pure plantations are often badly diseased when young.

With regard to the larch disease proper, there appears to be three fairly distinct points of view from which it can be studied; first: the scientific, which only concerns itself with the identification, classification, and biology of the disease producing fungus; second: the silvicultural, which regards the disease as a factor in determining the method of growing the tree; and third, the economic, which comes into play when the profit or

loss account of a larch crop is reckoned up, or when the timber is placed in the hands of the timber merchant or the saw-miller for conversion.

As regards the scientific point of view, very little has been added to our knowledge of the life history of the fungus since Hartig's announcement some twenty years ago. The chief debateable points are the questions as to whether the fungus is a true wound parasite, and can only enter through a broken or wounded surface or whether, given favourable conditions, it can gain a footing on any part of the tree not covered with true bark. As wounds occur in hundreds of ways which are quite out of the power of the forester to prevent, the question is probably of less practical importance than would appear at first sight, as the recommendations of the theorist with regard to pruning, thinning, larch aphides, etc., are quite impracticable in every day forestry. Another question which has never been satisfactorily solved is whether the fungus begins its work as a true parasite at all, or whether it gains a footing on the dead twigs which are found on the healthiest tree after branch suppression sets in. This question is still further complicated by Massee's assertion that the *Peziza Wilkommii* of Hartig is identical with *P. calyina*, as was assumed to be the case before Hartig's researches. As *P. calyina* occurs abundantly on the bark and dead branches of the pine family, the point is not only one of great interest, but might have some practical significance where larches and pines are mixed together, as is often the case. In most cases, however, larch disease is now so wide-spread, that little importance need be attached to its identity. In a few isolated districts, it might be a question of expediency whether the two families should be mixed; but even then the matter is rather a silvicultural question than anything else, as the object of the practical forester is not merely to grow perfectly healthy crops so much as crops which will pay for the trouble and expense of rearing them. If, for any reason, a mixture of pine and larch proves to be the most profitable under the prevailing conditions, it would require rather more evidence than is now forthcoming on the scientific side to condemn the practice as bad forestry.

To the average forester, however, the silvicultural point of view is, after all, the most interesting and important. In what

situations and on what soils should larch be planted? Should it be planted pure or mixed? If mixed, what species provide the best conditions for the healthy development of the larch? These are all questions which have long been before practical foresters, but never answered satisfactorily. So far as soils and situations go, both sound and diseased larch may be found on all classes. In the same way, it has never been proved or disproved that pure crops of larch are more or less subject to disease than those mixed with other species; taking, not the absolute, but the percentage, number of diseased trees in the two cases. As regards the best species for mixing with larch, there is little doubt that the best developed individual trees are more often produced amongst broad leaved trees, such as beech or oak, than amongst conifers, although we have to rely upon experience rather than statistics in confirming this.

In Professor Mayr's book on "Exotic Forest and Park Trees," which is reviewed elsewhere, the author's experience of the best conditions for cultivation, and the character of larches generally, is as follows:—

1st.—All larches are fairly insensitive to frost, and will bear — 6 C. without injury when the dwarf spurs are breaking into leaf. *L. sibirica* is more liable to injury from late frosts, and *L. leptolepis* from early frosts than the European variety.

2nd.—All larches are quick growers to begin with, and are light demanders. When the larch is used for filling up gappy beech or spruce woods arising from natural regeneration, success is only ensured by cutting back the other trees for at least fifteen years.

Correct cultivation consists in planting in sufficiently large groups, which should be thinned early, and all crooked individuals removed independently of their size, and the breaking up of the leaf canopy. Underplanting with shade-bearers, or planting on ground which already carries a crop of scrub, is recommended.

3rd.—All larches like good deep ground. On gravelly or poor soils they only succeed for the first twenty years, after which their growth falls off, and the trees usually succumb to lichens and blister. The warmer the climate, the fresher the ground must be.

The solution of the larch question, says Professor Mayr, depends upon the above rules being carefully followed until disease-infected areas are again free from fungus, and other enemies proportionately reduced.

This author also states his opinion that all larches, whether European, American or Japanese, have the same biology, and require the same conditions of growth. Conditions which produce a bad quality of timber, or bad health in the one, will be likely to do so in the other, and there is little prospect of a species being found which does not share the failings of the European species when planted under similar conditions.

Probably many British foresters will not agree with all Professor Mayr's opinions, but they are at least worthy of consideration. That careful cultivation and choice of soils, situations, etc., will do much to counteract the disease is very probable. But that it is likely to exterminate it sufficiently to render larch cultivation profitable in the future, where it now turns out a failure, is very doubtful, and the fact still remains that larch blister disease is not necessarily the cause of its failure everywhere.

The influence of larch disease in reducing the returns from a larch plantation is probably one of its worst features. On even unfavourable soils it often happens that larch reaches a size which would allow a small profit to be made on the crop were it not for the crippled and crooked condition of the trees through the blister. Larch of moderate growth can be used for pitwood at twenty-five or thirty years of age if free from defects, but where blisters occur on the stems of almost every tree, their value for this purpose, or even for fencing is greatly lessened, and as the blisters invariably occur within five or six feet of the ground, what should be the best part of a pole is of little value.

Where larch again is regarded simply as a "nurse" tree, the occurrence of blister, although of less importance to the main crop, does much to destroy the value of the early thinnings, which invest plantations containing a fair proportion of larch with their most valuable properties. Unfortunately no tree has yet been found which can take the place of larch in this respect, and it is perhaps the fact that Japanese larch is, so far as one can see at present, fairly free from disease for the first twenty

years or so, that justifies one in hoping that it may prove more useful as a nurse for either shade-bearing or fast growing species than the common variety.

At a later stage, when the surviving trees of a crop are approaching timber size, their value is often reduced by the blisters which, in bad cases, remain on the trunks, and increase with the growth in diameter of the stem. Where healing over has taken place about the twentieth year or so, as often happens on favourable soils, the timber is still slightly depreciated by the blemishes which are found when the trees are sawn up into rails, or other sizes which render the elastic strength of the wood of importance.

Both to the forester and timber merchant, therefore, the larch disease is a serious evil, and renders the chances of profitable forestry less certain than they appeared to be when this tree was at the height of its popularity. Any enquiry which will tell us more than we already know on the subject will be welcomed by all interested in forestry matters, and if the information is of such a kind as to render remedial or preventive measures, other than those already referred to, possible, it will prove of immense value. The only points which might be considered well before too much expense is incurred in such an enquiry are these: Is the blister disease worse than other larch diseases (e.g., root rot) on soils and situations favourable to the development of the tree? Or on soils and situations unfavourable, is not the disease the effect rather than the cause of the unthrifty crop? Or, in other words, is it the blister disease about which we want to know more; or the biology of the larch, which probably determines the fact that the disease is a serious evil in one case, and practically harmless in another. The enquiry now being conducted by the R.S.A.S. should throw much light on these questions.

A.C.F.

ATTENTION has recently been attracted to the method of "combating larch disease" on the Estate of Mr. Munro Ferguson, of Novar, in Rosshire, by a short paper in the Board of Agriculture Journal, for March, 1906. The larch is planted pure, about three-and-a-half feet apart, or 3,500 two-year seedlings to an acre, being employed. These are not thinned until they are

sixteen to twenty years old, when a partial clearance takes place, all being cut except from 300 to 500 per acre of the best trees. These are found to measure up to fifty-one feet in height, and four to eight inches diameter, breast high. The ground is then underplanted with two-year seedlings of Sitka spruce, Douglas fir, *Thuja gigantea*, Lawson's cypress, and *Abies grandis* at the rate of 3,000 per acre. A second clearance is intended to be made at a further interval of fifteen to twenty years, and at sixty to eighty years the whole of the larch will be cleared, leaving the ground fully occupied by the subordinate trees. As regards returns, the first thinnings realize £20 to £25 an acre, and as the best trees are retained, the financial result must be satisfactory.

It is stated that formerly an even aged mixed crop was planted, but the above system has now been substituted for it.

In the warmer and more forcing climate of the South-West of England, it is, however, very doubtful indeed if a crop of larch planted as this was, would not be so badly diseased at sixteen to twenty years as to require complete clearance. This only shows once more how impossible it is to lay down precise rules without giving due consideration to differences of soil and climate.

Since whatever precautions we take in the South-West of England, it seems impossible to altogether escape disease. The proper course to pursue seems to be to see that larch is planted under the best circumstances for its healthy development. Speaking generally, hot and thin soils, those that are wet and low-lying, and south and east aspects should be avoided. The trees must be well planted. Plants that are set either too deep or too shallow, or are allowed to be smothered in coarse grass, are in a weak condition for years, and cannot resist attack. But however well soil and aspect are selected, and the initial operations carried out, the rule that is universally accepted wherever Silviculture has been studied must not be forgotten. All Continental foresters are agreed that in order to obtain the best results, light demanding or intolerant species should always be associated with such as are shade-bearing or tolerant. In spite of the experience at Novar, it is believed that in the South of England it will be found that the

larch disease will be more effectually combated if from the start it is grown in a mixed plantation. As regards the particular shade-bearer to be planted, preference should be given to beech over spruce or silver fir, as permitting a freer access of air and light to the larch. Sycamore is a tree that might be planted with larch to advantage, but if planted at four foot intervals, even aged, it grows so rapidly that about the fourteenth to sixteenth year there is a danger of its commencing to form a crown. This mixture would therefore require careful observation in order that the larch should be protected. Beech, however, is the tree that fulfils all requirements. It grows more slowly than the larch and will tend to keep the latter clean, while stimulating its growth by keeping the surface shaded and free from grass as well as by the valuable humus derived from its leaves. No one who has seen the extraordinary development of oak in the Spessart-wald when grown in mixture with beech can doubt that a similar result would be attained by its association with larch which, in many respects, is similar in its requirements to the oak.

It is not asserted that larch grown in this manner will escape disease. The writer has seen evidence of it in the tops of healthy larch trees containing upwards of fifty feet of splendid timber, and believes that very few entirely escape. What is, however, advanced with some confidence is, that larch planted under the best conditions of soil, climate, and in mixture with beech will progress in such a healthy and thriving condition that the results of the disease will be almost negligible.

At Cirencester, a plantation of one half Scotch, and one half Tyrolese larch was planted in 1893, five feet apart; chiefly larch, about ten per cent. of spruce and Scotch, and the same of beech and sycamore. Unfortunately, much of the beech has been destroyed by rabbits. In 1900, a good many larch were damaged by squirrels. In this district larch canker seems to appear after wet summers and mild winters. The year 1902 was wet, and the succeeding winter mild, and in 1904 there were a good many blisters to be seen. In 1905, about seven per cent. of the trees were cut out, chiefly those damaged by squirrels and those which

were dominated, the latter being, naturally, the most blistered. A good many trees still standing are also blistered, particularly on the dying branches, but the trees are thriving and I think they will grow on and make good timber. The part where Tyrolese larch was planted is the best grown and most free from disease. The average height is now about twenty feet, and in parts where the soil is better, there are many poles thirty feet. I think five feet is a little wide for larch as the side branches get too strong before the boles clean themselves, and that four feet, or even three-and-a-half feet, would have been better in this instance.

R. ANDERSON.

THE IRISH FORESTRY SOCIETY & ITS WORK.

"TREES, I would have none in it, but some thickets . . .," said Francis Bacon, 295 years ago, referring in one of his Essays to the portion of his ideal garden, which was to be left in a wild state, and ten years hence Ireland may be found to have attained the Philosopher's ideal, if the present apathy, accompanied by denudation, continues.

With Land Acts, which set a double premium upon the destruction of trees—first by the landlord, who naturally does not wish to convey to the tenant (the purchaser) more than is paid for; and secondly by the tenant purchaser, who seeks to partly recoup himself by the sale of any timber he may happen to have acquired, and at the same time to extend and enhance, according to his lights, the value of his arable land—not much else can be looked for unless remedial measures are adopted.

Of this latter more anon. But meanwhile it is important to make clear to the minds of the present readers, and consequently future supporters of this Journal, the fundamental differences that exist between Ireland and the rest of the United Kingdom from an arboriculturist's standpoint in order that the focus may be properly adjusted from the outset. The difference, however, is not in the natural laws governing the propagation of timber trees, which are, of course, the same as in England, only perhaps more intense, but is one of Statute law and social conditions.

For example, there is the Land Act of 1903, and the far-reaching consequence arising from its operations. The purpose

of the Act, as every one now knows, is to transfer the rural land of Ireland [from the owners thereof to the occupiers, with the initial result already shown. Another result is, that in addition to the arable land, very much waste land unfit for agriculture, and economically considered, unfit even for grazing—in fact, one might almost say hypothecated by the Creator for planting, is passing into the hands of the tenants, and incidentally is lost probably for ever for afforestation purposes.

A third result, and the last to be referred to at this time, is that many landowners are selling everything and clearing out of the country altogether.

When it is explained that this huge transition is taking place at the rate of about half-a-million acres per annum, and there are a little short of 21,000,000 acres in the whole of Ireland, it will readily be recognised how pressingly urgent is the need of securing at least a portion of the "waste" land—preferably by the State—in order to ear-mark it for timber-growing on an adequate, i.e., a Continental scale. From the standpoint of the Irish Forestry Society, this question has overshadowed for the present all others in importance and urgency, and while the kindred and more venerable societies in England and Scotland were placidly wandering as the spirit led in the classic groves of academic thought and discussion, this infant prodigy—boasting in all but five lusty summers—had to speedily discard the nascent wrappers for the targe and buckler of the political arena; that is, pertaining to Policy, not to Party.

The little Society can point to the establishing of the first State School of Forestry properly so-called, in the Kingdom, as in large part constituting its first scalp; also to other beneficial developments in the direction of the organisation of State forests on a portion of the waste lands alluded to.

Other matters only second in importance to the foregoing are receiving close and anxious attention from the Society, and which must at least be mentioned, although space forbids any extended reference. Among these is the education of the rustic intellect as to the character and benefits of National forests on the one hand, and tree cultivation for shelter and ornament, in a word, arboriculture, on the other hand. Whether the present generation of farmers can be adequately converted is

problematical, not to say doubtful, but in any case the greatest prospects of ultimate and permanent success lie with the children now at school.

This touches a point—the distribution of population—which, as has been said, raises more *intense* problems in Ireland than it does further East, for in Ireland four out of every five of the population live a rural life depending directly on the capricious resources of the land, whereas in England, and also in Scotland, rather less than two in every five do so.

There are, of course, other differences, as for instance the vastly greater value of waste lands across the channel for sporting purposes—the ratio expressed in numerals would be about 1 to 20—and Ireland does not possess the wealthy resident land-owning class which does so much for forestry north and south of the Tweed.

The policy of popular education has led the Irish Society to support and encourage a movement to establish an “Arbor Day” in Ireland on the lines now familiar and emanating from America.

From the foregoing it will be gathered that the Irish Forestry Society is essentially a “popular” body, and as might be expected its membership includes not only the leading forestry experts of the country, but a number whose sole interest in the subject arises from a recognition of the importance of afforestation to the country at large.

On this account the advent of a Journal of Forestry, synthesising the responsible thoughts and ideas most worthy of consideration and adoption, cannot fail to appeal to a membership which by the force of circumstances has been largely debarred, up to the present, from participating in instructive discussions bearing upon the different aspects of forestry which their professional kinsmen across the channel have long been familiar with.

There is much also to be gained from this common platform upon which devotee may meet with devotee with that hand-grip which does so much for the creation of mutual respect, sympathy, and support.

J. SCOTT KERR,

Joint Hon. Sec. Irish Forestry Society.

THE CREOSOTING OF HOME-GROWN TIMBER.

THE table compiled by Mr. W. B. Havelock, given on next page, should be of the greatest interest to British foresters. At Brocklesby, one of the most up-to-date creosoting plants in the country exists, and for several years back Mr. Havelock has carried out trials with almost every species of wood grown in England. The results, of course, so far are not absolutely conclusive, as the proportion of heart-wood to sap-wood in each sample, its rate of growth and other factors, will vary, and it is only by testing hundreds of samples that reliable average figures can be obtained. But in spite of these deficiencies the figures given are of great value, and are probably the most complete and exhaustive, so far as the number of species dealt with is concerned, of any that have yet been made with British grown woods.

Mr. Havelock writes that the table shows the result of tests to ascertain absorption of Creosote Oil under high pressure, by 56 kinds of timber, grown on the estate of The Right Hon. The Earl of Yarborough, Brocklesby Park, Lincolnshire.

The timber was sawn to the sizes stated below, and naturally seasoned in the open air; and the Oil injected under a pressure of 80 to 85 lbs. per square inch (5 to 6 atmospheres) for 3 hours. The Creosote Oil (sp. gr. 1.040, costing 2½d. to 3d. a gallon delivered to the purchaser's yard), was warmed by steam during use, and a vacuum of 9 lbs. was obtained in the cylinder before the oil was injected. The last column of figures shows the absorption of Creosote per cubic foot of the wood impregnated.

Reference No.	Species of Timber.	Number of Pieces.	Size of Pieces.	Weight before Crosscutting.	Weight after Crosscutting.	Total Increase in Weight.	Contents of each Piece.	Weight of Creosote Oil absorbed by each piece.	Weight of Creosote Oil absorbed per cub foot.
			FT. INS. INS.	LBS.	LBS.	LBS.	CU. FT.	LBS.	LBS.
54	Alder	2	6 x 3½ x 3½	33½	74½	41½	.51	20.81	40.80
89	Corsican Pine	6	"	104	198½	94½	.51	15.73	30.84
17	Lime	2	"	32½	62½	30½	.51	15.25	29.90
33	Scots Pine	2	"	33½	63½	30½	.51	15.25	29.90
8	Austrian Pine	5	"	103½	171½	68½	.51	13.67	26.80
14	Menzies Spruce	2	6 x 3½ x 3	26½	48½	22½	.43	11.06	25.72
10	Heavy-wooded Pine	2	6 x 3½ x 3½	30	52½	22½	.51	11.31	22.17
22	Beech	4	"	106	150½	44½	.51	11.21	21.98
75	Hazel	2	5 x 3 x 3	27½	41	13½	.31	6.68	21.54
60	Hornbeam	2	6 x 3½ x 3½	54½	76½	21½	.51	10.93	21.43
34	Sycamore	2	"	40½	62½	21½	.51	10.87	21.31
12	Walnut	2	"	43	64½	21½	.51	10.87	21.31
37	Horse Chestnut	2	"	45½	66½	21½	.51	10.68	20.94
31	Norway Spruce	2	"	33½	53	19½	.51	9.62	18.86
87	English Maple	3	"	73½	100½	27½	.51	9.04	17.72
70	Ash	6	"	142	194	52	.51	8.66	16.98
41	Wellingtonia	2	"	27½	44½	16½	.51	8.43	16.53
158	Trembling Aspen	5	"	104	143½	39½	.51	7.85	15.39
1	Red Cedar	2	6 x 3 x 3	24½	35½	11½	.37	5.56	15.02
40	Silver Fir	3	6 x 3½ x 3½	46½	69½	22½	.51	7.54	14.78
3	Spanish Fir	2	"	31½	46½	15	.51	7.5	14.70
112	Brown Oak	3	"	73½	95½	21½	.51	7.17	14.05
82	Himalayan Pine	3	"	42½	64	21½	.51	7.17	14.05
21	Birch	1	"	22½	30½	7½	.51	7.12	13.96
38	English Elm	4	"	99½	126½	26½	.51	6.71	13.15
104	Oriental Spruce	3	"	41½	61	19½	.51	6.50	12.74
58	Apple	2	4 x 3½ x 3½	36	44½	8½	.34	4.31	12.67
59	Elder	1	6 x 3½ x 3½	25½	31½	6½	.51	6.37	12.49
61	Weymouth Pine	2	"	28½	41½	12½	.51	6.37	12.49
13	Cedar of Lebanon	2	"	38½	51	12½	.51	6.18	12.11
26	Black American Spruce	2	"	32½	44½	12	.51	6.00	11.76
106	Japanese Cypress	1	"	20	25½	5½	.51	5.75	11.27
28	White Thorn	4	"	111½	133½	21½	.51	5.46	10.70
19	Douglas Fir	5	"	84½	110½	26½	.51	5.22	10.23
56	Blackthorn	1	6 x 3 x 3	17½	21½	3½	.37	3.62	9.18
47	Japanese Cedar	1	6 x 3½ x 3½	21½	26½	4½	.51	4.62	9.06
11	Portugal Laurel	4	"	109½	127½	18½	.51	4.59	9.00
71	Black Poplar	2	"	34	43½	9	.51	4.56	8.94
74	Deodar Cedar	2	"	34½	43½	9	.51	4.50	8.83
142	Swiss Stone Pine	3	5 x 3½ x 3½	40½	51	10½	.42	3.62	8.61
20	Crab	2	6 x 3½ x 3½	59½	68½	8½	.51	4.43	8.51
39	White Beam Tree	3	"	54½	66½	12½	.51	4.17	8.17
63	Scarlet Oak	4	"	120½	135	14½	.51	3.59	7.03
5	English Yew	2	"	53½	60½	6½	.51	3.37	6.60
73	Huntingdon Willow	4	"	59½	72½	13½	.51	3.37	6.60
15	Wild Cherry	4	"	80½	93½	12½	.51	3.18	6.23
30	Mountain Ash	2	"	46½	51½	4½	.51	2.37	4.64
48	Turkey Oak	2	"	65½	70½	4½	.51	2.31	4.53
16	Lobb's Arbor Vitæ	3	"	57½	64½	6½	.51	2.25	4.41
18	Evergreen Oak	2	"	74	78½	4½	.51	2.25	4.41
44	Wych Elm	2	"	47½	52	4½	.51	2.18	4.27
24	Laburnum	2	5 x 3 x 3	33	35½	2½	.31	1.12	3.61
32	Larch	2	6 x 3½ x 3½	43½	46½	3½	.51	1.56	3.06
69	English Oak	5	"	138½	145	6½	.51	1.27	2.49
4	Acacia	6	"	162½	166½	3½	.51	.64	1.25
27	Spanish Chestnut	3	"	88½	90½	1½	.51	.62	1.21

The timber was winter-felled, and was first sawn into pieces 7 feet long by $4\frac{1}{2}$ inches by $4\frac{1}{2}$ inches, then stored outside, protected from rain, for six months. The pieces were then resawn to 6 feet by $3\frac{1}{2}$ inches by $3\frac{1}{2}$ inches, and piled again as before for another month before being creosoted.

FENCE POSTS.

Creosoted at the same time, and under similar conditions as the above different kinds of Timber.

Reference No.	Kind of Posts.	Number of Posts.	Size of Posts.			Weight before Creosoting.		Total increase in Weight.	Contents of each Post.	Weight of Creosote Oil absorbed by each post	Weight of Creosote Oil absorbed per cub. foot.
						LBS.	LRS.				
			FT.	INS.	INS.	LBS.	LRS.	LBS.	CU. FT.	LBS.	LBS.
34	Sycamore ...	8	6½	x	6 x 5	293½	480	186½	1.35	23.31	17.26
31	Norway Spruce ...	8			"	294½	478½	183½	1.35	22.96	17.00
33	Scots Pine ...	8			"	284½	466½	181½	1.35	20.21	14.97
40	Silver Fir ...	7			"	234½	339½	105	1.35	15.00	11.11
31	Norway Spruce ...	8	5	x	6 x 4	213½	329½	116½	.83	14.53	17.50
34	Sycamore ...	8			"	274	386½	112½	.83	14.03	16.90
33	Scots Pine ...	8			"	223	329	106	.83	13.25	15.96
19	Douglas Fir ...	4			"	101½	120½	18½	.83	4.71	5.67
69	Oak ...	16			"	665½	731½	65½	.83	4.11	4.95
32	Larch ...	8			"	235½	258½	23	.83	2.87	3.45

NOTE.—The Scots Pine Posts, being sawn out of old, well hearted park trees, have absorbed less oil per cubic foot than if made from younger trees with less heart-wood.

NOTES ON PENETRATION OF CREOSOTE.

Size of pieces, 6 feet long x $3\frac{1}{2}$ x $3\frac{1}{2}$ cut in two in the middle.

No.

REMARKS.

- 54 Alder—saturated.
- 89 Corsican Pine—quite through, medium rings.
- 17 Lime—saturated.
- 33 Scots Pine—more than three parts through, wide rings,
- 8 Austrian Pine—saturated.
- 14 Menzies Spruce— $\frac{1}{2}$ to 1 in from sides, none in middle, wide rings.
- 10 Heavy Wooded Pine—saturated, rather wide rings.
- 22 Beech—saturated (3 pieces).
- 75 Hazel—1 quarter creosoted, no trace in remainder of centre.
- 60 Hornbeam—completely saturated.
- 34 Sycamore—saturated, medium rings.
- 12 Walnut—about three parts done.
- 37 Horse Chestnut—all saturated but portion near pith, medium rings.
- 31 Norway Spruce—nearly saturated.
- 87 English Maple—saturated except one inch circle round pith.

No.	REMARKS.
70	Ash—practically through.
41	Wellingtonia—little near outside only creosoted.
158	Trembling Aspen—not quite through, patchy.
1	Red Cedar—fairly well done, but patchy.
40	Silver Fir—patchy, but nearly saturated, large rings.
3	Spanish Fir—about one inch from outside, none in centre.
112	Brown Oak—nearly saturated.
82	Himalayan Pine—four-fifths saturated, none near pith.
21	Birch—about half-inch from outside, and a little in the middle.
38	Red Elm—saturated, slowly grown, no pith.
104	Oriental Spruce—stained more or less, decreasing towards centre.
58	Apple—saturated excepting a circle 1 in. diameter in middle.
59	Elder—nearly saturated.
61	Weymouth Pine—three parts saturated, slowly grown, and contains pith.
13	Cedar of Lebanon—creosoted half-inch from sides, none in centre, medium rings.
26	Black American Spruce—irregularly, certain inner rings stained, others not, medium rings.
106	Japanese Cypress—sap-wood saturated, but very little heart-wood affected.
28	White Thorn—about half saturated
19	Douglas Fir—sap-wood saturated, and part of heart-wood.
56	Blackthorn—about two-thirds saturated, but does not follow annual rings.
47	Japanese Cedar—about half creosoted, chiefly near corners.
11	Portugal Laurel—blotchy, but covers nearly half surface.
71	Black Poplar—practically saturated, narrow rings.
74	Deodar Cedar—about one-third, chiefly near outside, and a little through annual rings
142	Swiss Stone Pine—sap-wood only, heart-wood untouched.
20	Crab—right through.
39	White Beam Tree—irregular, $\frac{1}{2}$ to 1 in. from sides, none in centre.
63	Scarlet Oak—sap-wood saturated (three parts is sap-wood).
5	English Yew—About $\frac{1}{2}$ in. from pith side only is creosoted.
73	Huntingdon Willow—Sap-wood at corners only, imperceptible in remainder.
15	Wild Cherry—sap-wood and near edges, none in centre.
30	Mountain Ash—only $\frac{1}{2}$ in. from outside edges, none in centre.
48	Turkey Oak—patchy, taken very little.
16	Lobb's Arbor Vitæ—sap-wood fairly well done, very little in heart-wood.
18	Evergreen Oak—speckled, but very little absorbed on whole.
44	Wych Elm—chiefly near sides, and in 1 in. diameter of pith.
24	Laburnum—sap-wood only creosoted.
32	Larch—scarcely perceptible, all heart, with narrow rings.
69	English Oak—In sap-wood only, not perceptible in heart-wood.
4	Acacia—practically none.
27	Spanish Chestnut—Scarcely discernible (chiefly heart-wood).

NOTES ON THE TREES
SEEN AT BICTON, KILLERTON, POLTIMORE,
AND POWDERHAM.*

BICTON is certainly one of the most interesting places in Great Britain to an arboriculturist, on account of the very rich collection of trees which has been planted there at various intervals during the last century, many of which, on account of the very favourable soil and climate, have thriven exceedingly.

The Notes on Bicton printed in the Programme of the Society's Meeting, and the List of Coniferæ which was distributed to the members present, will make it unnecessary for me to say more as to the history of the place, but though I spent a whole day here in 1902, and made the most of my time on this occasion, I have no doubt that I have overlooked many trees of great interest and rarity, and must content myself with a brief notice of those which struck me most.

As to the avenue of Araucarias, which is the most celebrated feature of Bicton, I need only say that they do not seem to be increasing fast in height or girth, the largest girth that I took in 1902 being 8 feet 9 inches, whilst now the largest measured was barely 9 feet. Mr. Muirhead told me that he had not noticed any perceptible difference between the habit of the male and female trees, which has been noticed to exist in some places, but which in Chile I failed to observe myself. I do not think the tree is likely to attain its full size in this part of England, as it seems more at home where the winters are colder than in South Devon.

Before entering the garden I noticed one of the finest black poplars (*P. monilifera*) which I have seen, measuring about 125 feet by 17½ feet with a clean bole about 40 feet long.

In the garden is a very fine deodar which exceeds in girth any I have measured in England, and which appears to have increased considerably since 1902, but another of the same kind growing close to the water below is much taller, and the best grown deodar I have seen out of the Himalayas. A small specimen of *Nyssa sylvatica*, the Pepperidge tree of Canada, which is very rare in England, was bearing fruit; the first I

*Visited by the Royal English Arboricultural Society, Aug. 14th to 18th, 1906.

have seen in this country. A large *Paulownia imperialis* near it, whose trunk shows signs of rapid decay, was in bud; this tree seldom flowers except in the very warmest parts of England.

Coming into the Pinetum from the garden, there are to be seen some of the finest trees I know of the Himalayan *Juniperus recurva* and of other rare Junipers and Cypresses, which will require careful study before their names can be accurately made out; for though I have seen several of these in their own countries, and have studied the work of Kent, Dr. Masters and others, some of the species of these genera vary so much, and assume such diverse habits in this country, that their nomenclature is very difficult.

An immense but very ill-shaped tree of the Cephalonian silver fir, which has lost a huge limb near the ground, measured no less than 13 feet in girth, and must be over 80 feet high, the climate and soil seems too damp and rich to suit it; as appeared to be also the case with a somewhat similar tree at Powderham Castle.

The rare *Cunninghamia sinensis*, though of unusual size, is, as always in England, somewhat ragged; but the beautiful Japanese *Cupressus obtusa* (usually known as *Retinospora*, and here called *R. squarrosa*) and *Cupressus pisifera* seem to be thoroughly at home, and are becoming trees instead of bushes; the form in which they are usually seen in English gardens.

Pinus peuke, the Macedonian representative of *Pinus excelsa*, is so flourishing, and so large considering its age, that I did not at first recognize it, but I am very sanguine that it will be one of the most satisfactory pines for soils which do not contain lime.

A number of pines from Mexico and other countries are here grown under the names by which they have been sent out by nurserymen at various times, and among them are several which would puzzle the most experienced arboriculturist; but as many of them have been raised from seed by Mr. Barrie, and presented to the Society by Mr. Rolle, we shall have the opportunity of seeing how they develop at Oxford under Professor Fisher's care.

A superb *Cryptomeria*, very nearly the largest I know in England, and some beautiful trees of *Thuja*, here known as



2



3



4

- 1.—*Eucalyptus coccifera* at Powderham, 13 feet circumference, about 80 feet high.
- 2.—Avenue of *Araucaria imbricata* at Bicton, 60 years old.
- 3.—*Wellingtonia gigantea* at Bicton Plantation, height 98 feet, girth 17 feet 5 inches.
- 4.—Ash felled and trimmed at Powderham, 27 feet 1st length by 14 feet 10 inches average girth, over 200 years old, 330 cubic feet.

From Photographs taken by Mr. N. Temperly.

T. Lobbi, and more generally as *T. gigantea*, but which I am afraid we shall have to call by the name of *T. plicata*, have all grown several feet in height in the last four years. A number of the more recently introduced conifers have been planted in a very sheltered piece of ground by the present owner of Bicton, among which I noticed *Pinus contorta*, *Picea omorika*, and several other varieties from Japan and elsewhere. *Cedrus atlantica glauca*, though tall and flourishing, does not seem to be so well adapted to this soil and climate as its Himalayan cousin, though in dryer parts of England it succeeds wonderfully well.

After lunch I walked round the arboretum walk from the house, and noticed the great difference in the growth of some of the trees at its upper end, as it is somewhat exposed to the south-westerly gales, and many deaths must have occurred here in recent years.

The first tree I noticed here was a very fine and well-grown *Libocedrus decurrens*, among the largest of its kind in England. A little further on was a beautiful weeping lime of the species known as Crimean lime (*Tilia petiolaris*), of which the native country is somewhat doubtful. It seems to be always tall and slender in its trunk, and like most of those I know of about the same age is grafted at seven or eight feet from the ground. This and the silver lime (*Tilia argentea*) both seem to me much more beautiful and suitable trees for park and avenue than the common red-twigged lime, and the silver lime as I saw it in the forests of Bosnia is one of the most beautiful leaved trees in Europe. A fine, straight, young and vigorous tree of the Oregon maple a little farther on, is the best, though by no means the largest of its species I have seen in this country, and seems to show that the south-west is the only part of England in which this large and splendid tree can be expected to come to perfection.

A number of rare elms, ashes and maples required much more time than I was able to devote to them, and cannot now be mentioned in detail; but farther on, in a damp piece of ground which seemed to suit them perfectly, I found some fine alders of several species, as well as the only large and healthy specimen of the American paper or canoe birch (*Betula*

papyracea), which seems to owe its vigour to being grafted, probably on the European birch.

In a group of four species of hickory, *C. alba* was the tallest, straightest, and most vigorous; *C. porcina* with very large leaves forming a comparatively spreading top.

Farther on are a great many varieties and species of oaks from America and the South of Europe, which again will require careful study to identify them properly; among them is the fine tree of *Quercus Mirbecki*, which I remarked here on my first visit, an Algerian species which seems to thrive remarkably in the few places where it has been planted in the southern counties. Among a group of planes was a very curious small-leaved variety, with smooth bark (No. 2568 in the Bicton catalogue) which I had never seen before, though I have seen similar leaves appear as a sport on one branch of the London plane.

The variety of trees at Bicton, however, is so great, that it was impossible to do more than glance at many of them, and I leave all details as to the large specimens in the park to other members of the society.

POLTIMORE.

On the next morning we passed through this fine park and grounds on our way to Killerton, and saw some pedunculate oaks and English elms of great size.

A broad lime avenue, in which the fruit was in an unusually mature condition for the time of year, shows the favourable soil of Poltimore, and the avenue of deodars at the north end of it which was planted in 1851-52, is perhaps the best example of the fitness of this tree for avenues, that I have seen. But one or two blanks have already been made in it by the comparatively sudden death of trees from a cause which is not yet explained, but which can here hardly be due to soil or climatic causes. The trees are fairly regular in height and girth, about 70 feet by 7 feet being the average dimensions of the best of them.

On one side of this avenue are some fine conifers, of which two gigantic *Sequoias* are among the tallest in England. One of them, according to my measurement, is 98 feet by 16 feet



"This plate represents a very remarkable *Cryptomeria* growing in the grounds of Endsleigh, which is covered to a degree which I have never seen equalled in any other tree, with what I may term nipples. These excrescences are not connected by any woody growth with the trunk but only by the bark, and are not unfrequently found on Cedars. I cannot explain their cause, but they are quite distinct in structure from ordinary burrs. Including these excrescences the trunk of this tree measures no less than twelve feet nine inches in girth, and many of the nipples were four to six inches or more in length."—*H. J. Blues*.

[These nipples are apparently sleeping buds or eyes which German botanists term "Sphaeroblasten." They arise from the dormant buds, present in large numbers on most trees, becoming detached at the base from the vascular bundles previously connecting them with the stem. They are common on Beech, Cedar, etc.—*Ed.*]



Photos]

[R. G. Foster, Burford

CEDAR AVENUE AT POLTIMORE.

9 inches at five feet from the ground, but Mr. Slade, the head gardener, believes that it is taller, and some members of the Society thought that the specimen nearer the mansion was the taller tree of the two. Near this, was a fair specimen of what I believe to be an original Lucombe oak, which Lord Poltimore assured me, has been a good sized tree as long as he can remember, but which is by no means so fine as those we saw at Killerton.

KILLERTON.

One of the first trees to which my attention was called here was a very fine elm growing in the middle of an arable field in the occupation of Sir C. T. D. Acland, which would not on many estates have been allowed to survive. It puzzled me to say what it was, as it combined the weeping habit of an American elm, such as one sees in old places in New England, with the leaves of the southern form of wych elm called *Ulmus glabra*, and until I have seen the flowers and seeds, of which I could now find no trace, I must leave it in doubt. It measured about 92 feet high by 16 in girth, and is a very beautiful tree. On reaching the gates of the park we first saw some fine American red oaks, which I had not previously seen, near them being perhaps the healthiest specimen of *Quercus velutina* that I know in England.

We then were taken by Mr. Coutts to see a plant growing on the wall of the house, which is of such rarity in England, and so difficult to cultivate, that it reflects the very highest credit on his skill. This was *Mutisia decurvens*, a Chilean climber with immense scarlet composite flowers, something like those of *Gerbera Jamesoni*, but finer, and though I have seen it in many places in its native country, I never saw it so well flowered as here.

The splendid tulip tree in the garden, though somewhat damaged by wind since I last saw it, is still one of the finest in Great Britain, and must be one of the oldest, as Sir Thomas Acland tells me that in a print of his house taken early in the last century it seems nearly as large as at present.

On the slope of the hill above the house is a collection of conifers and other trees of extraordinary size and beauty, which

I venture to say are unequalled in any one place of similar area in Great Britain. Among them are several species of Cypress of great size, and the largest specimen of *Thuopsis dolabrata* I know of, and also the finest example of the very rare Chilean *Fitzroya patagonica*, which from what I know of its habitat might be expected to grow into a large tree in the South-west of England if planted in the moist rich soil and situation which it loves. This tree being diœcious, and only female plants having as yet flowered in England, the seeds of this tree have proved infertile, as Mr. Coutts informed me, and it is to be hoped that fresh seed may soon be imported in order to give it a better trial than it has had at present.

A group of cork oaks here remind one very much of the cork woods at Algeciras in Spain, but what proves better than anything what a wonderful soil and climate Killerton has is the fact mentioned by its owner in a letter which was read at the luncheon, that with few exceptions all the trees we saw were planted by his grandfather during his occupation of Killerton.

After lunch we proceeded to see the Lucombe oaks, of which we had already seen many planted along the road from Broadclyst, and whose history I endeavoured briefly to explain to our members. Having visited all that I can hear of in England of any age, I can say that no place has finer specimens than Killerton. The two forms confused under this name are quite distinct in their origin, and here show their peculiar characters remarkably well. Both forms bear acorns which I have raised, but the seedlings vary much, and I have never seen one of the hybrid kind approaching the original Lucombe oak in size. Near the chapel, built sixty-four years ago by Sir T. Acland, are some fine *Cupressus sempervirens* and *Cupressus funebris*, presumably of the same age.

On the wooded hill behind the garden we saw a plantation of the true stone pine, *P. Pinea*, often confused with the Pinaster or Maritime pine, from which it differs conspicuously in habit, cones and seeds, but though these trees, which are very rarely seen thriving, even in the warmest parts of England were six to seven feet in girth, and produced abundance of good seeds, of which the squirrels seemed extremely fond, their ragged upper

branches and somewhat unhealthy aspect seemed to show that both soil and climate were too damp for them to assume the same peculiar umbrella like habit that they have in Italy and in one or two favoured spots in England.

Our time was too short for Killerton, as for Bickton, but I am sure that all members of the party will agree with me that to the arboriculturist at least, no excursion that the Society has made will leave happier memories.

POWDERHAM CASTLE.

The invitation to visit Powderham, which the Earl of Devon was good enough to send the Society, arrived too late to enable many of the members to avail themselves of it, but those who did will not easily forget what they saw, both in the beautiful rooms of the Castle, which contains some of the finest oak panelling of various periods which I have seen, and in the magnificent park and grounds. Though the oaks of Devon rarely if ever produce the immense tall clean trunks which some of us know in the Midlands, yet one of the pedunculate variety here was of its type a model, and had a clean straight stem 12 feet 11 inches in girth, said by Mr. Palairer, who showed it to us, to contain about 350 feet of timber.

The finest English elm for size and shape combined which I know of, had, since I saw it four years ago, lost some branches, but is still a noble tree, though others nearly as fine have succumbed to the gales.

Two of the largest original Lucombe oaks in England stand in the park close together, and both measure about 90 feet in height by 14 feet in girth.

An ash tree recently felled, on whose stump 206 annual rings were counted by Mr. Pritchard, must have been a giant, and the butt, which seemed perfectly sound, though perhaps a little "black-hearted," was considered by some of the members the finest log of ash they had ever seen.

Passing on to the American garden we saw a wonderful Eucalyptus tree, by far the largest now known to exist in Great Britain, which has grown considerably in height since I measured it four years previously. It bore unopened flower buds, as well as fruit of last year, which seemed to contain

perfect seeds, which it is to be hoped will be raised by Mr. Powell the gardener, as no more charming souvenir of the place could be given to guests, than a seedling of this splendid tree. An immense but not well shaped tree of *Abies cephalonica*, a very fine and growing tulip tree, over 90 feet high, and a number of splendid straight growing chestnuts and beeches and other forest trees in the wood above testified to the suitability of the soil for growing fine timber.

In the garden near the Castle we measured an immense *Sequoia gigantea*, which, though it has lost its top, has the largest butt I know of in England, no less than 17 feet 8 inches in girth at about five feet from the ground.

A very fine cork oak, a very wide-spreading *Pinus excelsa*, which was bearing cones of 1904-5-6 at the same time, and a huge standard *Magnolia grandiflora*, whose leaves were so much shorter and broader than when grown on a wall, that it might without its flowers be easily mistaken for another species, were the trees which seemed to me most remarkable, but again, as at Bicton and Killerton, time was too short to do justice to all the trees of a district, which I think contains more fine places, and more large, rare, and remarkable trees than any other in England.

H. J. ELWES, F.R.S.

SILVICULTURAL NOTES ON THE TAVISTOCK WOODS.

THE following is a compilation from notes taken during the summer meeting of the Society, by Mr. J. Smith Hill, Mr. J. P. Robertson, and Mr. F. H. Osmond Smith. At Bicton, Poltimore, Killerton and Powderham Castle, which estates were also visited, the interest was chiefly arboricultural, so that the present paper deals exclusively with the Tavistock woods.

Some notes on the Tavistock woods, by Mr. E. C. Rundle, the agent of the estate, were given in the prospectus of the meeting, which was distributed among the members; these valuable notes are also utilized here.

The greater part of the Tavistock estates of the Duke of Bedford formerly belonged to the Abbey of Tavistock, the wealthiest convent in Devonshire, suppressed in 1538 and subsequently conferred by Royal Grant on the Bedford family. There was no residence on the property till Endsleigh Cottage was built in 1810, in a picturesque position, in the valley of the River Tamar, about seven miles from Tavistock and close to Leigh, the hunting seat of the former Abbots. The estate contains 26,000 acres, of which 3,000 acres are woodland, and lies between the valleys of the rivers Tavy and Tamar. The annual rainfall is about 45 inches, and the temperature rarely falls below 22° F.

The country is much cut up by valleys; the hills and plateaux rising to 1,000 feet above sea-level, near Bent Tor, on the north. The geological formation is Devonian clay-slate, intersected by Elvan dikes, a hard trap rock, and by mineral veins. To the west of Tavistock, some rich copper and arsenic mines have been and are still worked. On a considerable part of the estate, to the north, the overlying rock is more or less hard volcanic ash, locally known as "freestone." This owes its origin to Brent Tor, the remains of an extinct volcano. Wherever this rock occurs, the soil is rich, and the grazing land of high quality.

The woods chiefly occupy the steep declivities on either side of the valleys of the Tamar and Tavy rivers, and on land formerly part of two commons. In the valleys, some fine oaks have been grown, but oak timber is often shaken, sessile oak being freer from this defect than pedunculate oak. Owing to the intermixture of these oaks, there is now scarcely any true sessile oak on the estate, although there are many intermediate hybrids resembling it. True sessile oak plants are therefore being introduced from the Spessart in Bavaria, and other places.

The woods may be classified as follows:—

Oak coppice	-	-	850	acres
Plantations since 1892	-	-	640	"
Older plantations and high forest	-	-	1566	"
Mine works and heathlands	-	-	212	"
				<hr/>
Total	-	-	3268	acres

Except that the oak coppice was treated with a twenty-five years' rotation, between 21 and 22 acres being cut annually, and yielding about $2\frac{1}{2}$ tons of bark per acre, besides 100 large faggots, there was no regular system of management until 1890. Previously, timber was felled only when it was absolutely necessary to do so, and no planting was done. On the succession of the present Duke of Bedford, a more vigorous system was adopted, a certain volume of timber being cut annually, and the area replanted. A working-plan for the Tavistock woods was prepared in 1898 by Professor Schlich, F.R.S., C.I.E., and he inspects the woods every year and reports to the Duke of Bedford on the progress made. All the woods, except those round Endsleigh Cottage, which are kept up for amenity, are now worked on commercial principles. Rabbits and squirrels are strictly kept down, and very little game is preserved. Rabbits still exist, however; last year 15,000 of these pests having been killed.

In 1892, considerable areas on which the timber had been felled required replanting, and this is now being done at the rate of 70 to 100 acres annually, the home nursery being large enough to supply most of the plants. As regards the coppice, chiefly pure oak, it has been found that the price of bark is so low (£3 15s. a ton) this year, that the net annual profit from twenty-five years' growth, after paying the cost of felling, and of stripping and transporting the bark, is only 2s.6d. per acre. The cost of grubbing stools, and thus thoroughly clearing the ground before planting, is £25 per acre—this is too expensive for practical forestry, so that after the underwood has been cut, the stools are simply stripped of bark down to the ground. Planting is then effected, and the shoots that grow up among the new plants are cut out two or three times, until the new plants grow sufficiently tall to kill out all new stool-shoots that may spring up.

Mr. R. G. Forbes, the forester, gave us the following figures regarding the yield from coppice:—

From an area of $5\frac{1}{2}$ acres, 12 tons 12 cwt.

of bark sold at £4 a ton	-	-	£50	8	0
--------------------------	---	---	-----	---	---

Faggots sold	-	-	33	6	0
--------------	---	---	----	---	---

Total revenue	-	-	£83	14	0
---------------	---	---	-----	----	---

Cost of preparing faggots	-	-	£27	10	6
---------------------------	---	---	-----	----	---

Peeling and stacking bark at 50s. a ton	-	-	31	10	0
---	---	---	----	----	---

Transport of bark to station at 6s.	-	-	3	15	7
-------------------------------------	---	---	---	----	---

Rail and delivery at Launceston	-	-	5	0	0
---------------------------------	---	---	---	---	---

Total expenses	-	-	£67	16	1
----------------	---	---	-----	----	---

Net profit, £15 17s. 11d., less than £3 per acre, or for twenty-five years' growth, say, 2s.6d. per acre annually.

Coppice here was formerly rated at 5s. to 7s. per acre, but in 1897 was reduced to 2s.6d. per acre, so that the net profit on the coppice just paid the rates on it.

After viewing the beautiful surroundings of Endsleigh Cottage, where there was much to see of purely arboricultural interest, we visited the slopes leading down to the river Tamar, and saw the coppice in process of conversion to high forest. The original crop, here consisting of oak and ash, had been felled, and oak, ash, larch and Scots pine planted in 1900. The coppice was cleared twice, and last winter the oak and ash plants were cut back level with the ground, the coppice shoots being again cleared. It is probable that the ash and oak plants were too large when planted, and they had become "hide-bound," or at any rate were not flourishing. After being cut back, however, they have in the first season sent up shoots nearly four feet long, which are straight and vigorous; the conifers are also thriving.

We next visited a fine plantation of Weymouth pine, pitted in 1900 with mattocks, with three years' old plants. The broad end of the blade is used as a *turfer*, the narrow end to loosen the soil, the plants being inserted with a spade. The cost of pitting with the mattock is about one-third that of ordinary

pitting. On the north side of the river damage had been done to the Weymouth pine buds by the pine-bud tortrix (*Retinia buoliana*, Schiff), but not on the south side. The plants there are nine to ten feet long. We then saw a plantation of pure oak, 3,000 plants to the acre, planted in 1900. The plants were pruned last year with the French *croissant*, or crescent-shaped billhook, which is figured in Vol. V., p. 212, of our "Proceedings." This implement is made locally for 3s.1d. The oak saplings are now nine to twelve feet high.

We then saw an experiment in the conversion of oak coppice into high forest by selecting one vigorous oak shoot from each stool and cutting the rest. The reserved poles are all badly shaken at the base. The wood will probably be cleared and replanted. The upper part of the slopes down to the Tamar, though with a northern aspect, is too dry for pedunculate oak, and sessile oak is to be tried there. The older trees along the Tamar, oak and ash, with some larch, have been thinned, and are to be maintained for scenic effects. They might now be advantageously underplanted with Douglas fir, silver fir, or beech.

Some fine Douglas fir trees, forty years old, 17 inches quarter-girth and 75 feet high, were seen. A quarter acre of these trees, including one larch, averaging 100 cubic feet quarter-girth, contained 31 trees, or 12,400 cubic feet (quarter-girth) per acre. One Douglas fir had been struck by lightning, the current following the roots across the road, in which it cut a deep trench. A fine larch, 70 years old, 100 feet high, and $21\frac{1}{4}$ inches quarter-girth at five feet, only tapered one inch in eight feet, and a spruce also 70 years old, was 100 feet high and $22\frac{1}{2}$ inches quarter-girth at five feet.

On the opposite side of the river were quarter acre plots of deodar, Atlantic cedar, Weymouth pine, red American oak, silver fir, etc., which we did not see, while on the plateau there is 70 acres of natural regeneration of beech, filled in with silver fir. The latter species grows well at Endsleigh, the largest, in Wareham wood, measuring 120 feet in height by 40 inches quarter-girth at five feet.

The following interesting plots were noted in our programme, but unfortunately we had not time to visit them :—

Morwell Down, $\frac{1}{4}$ -acre, 50 years old.

41 larch, 60 feet \times 6 $\frac{1}{2}$ ins. quarter-girth		
(at centre of bole)	-	= 717 c. feet
5 Scots pine, 40 feet \times 6 $\frac{1}{2}$ ins.	„	58 „
7 ash, 40 feet \times 6 ins.	„	70 „
6 elm, 40 feet \times 6 ins.	„	60 „
		<hr/>
Total	-	905 c. feet

Morwell plantation, $\frac{1}{4}$ -acre, 37 years old.

81 larch, 60 feet \times 7 ins. quarter-girth (at chest height)	-	= 533 c. feet
---	---	---------------

Along the main road by the river Tamar is a fine clump of ash saplings, about fifteen years old. It is proposed to under-plant them with silver fir; Douglas fir was suggested, but probably any conifers planted would soon kill out the ash, and alder would be most suitable, as the ground is wet.

We again visited an area of coppice being converted into forest. It was cleared and planted in 1903-4 with one year seedling oak and two years' old larch, the oaks being six feet apart, the larch filling it up to three feet. A few Japanese larch were interspersed. The larch is growing well and about four feet high. The oaks are also thriving. It will be interesting to see in future years how these little oaks support the cover of the stronger larch plants. Another adjoining area, where coppice had been cleared, was planted with oak and larch in alternate lines, three feet apart. Here oaks, two to three feet high, and larch, 2-1, were used, both species doing well. In the course of the afternoon some older oak and larch woods were visited, and there the oaks were holding their own well against the larch.

After taking of an excellent lunch, hospitably provided for us by the Duke of Bedford, whose health, as well as that of the Duchess, and those of Mr. E. C. Rundle, the agent, and Mr. R. G. Forbes, the forester, were duly honoured, we proceeded to see some older oak and larch plantations made seven or eight years ago. The oaks were holding their own well against the larch. It is intended in these oak and larch plantations to cut out the larch when it attains commercial

dimensions, and to underplant the then pure oak wood with beech or silver fir.

In order to preserve continuity in this account of the coppice woods, I omitted to say, that before lunch we visited a crop of Scots pine, in Grenoren wood, 37 years old, averaging 47 feet high and $6\frac{1}{4}$ inches quarter-girth. Half an acre of this had been pruned of all dead side branches, up to 30 feet. It took a man and a boy with a ladder three days to prune the trees, at a cost of 18s. an acre, but it might have been done with a pruning chisel on a pole for 5s. an acre. This crop contained 3,248 cubic feet per acre.

The effects of the sulphurous fumes from arsenic mines on the oak coppice were noted. It is remarkable to see, now that the mines are working further away from the coppice, that the crop is becoming green and shooting out, showing how vigorously oak coppice resists such fumes, though while the mines were in full swing, the coppice shoots were terribly blasted.

Our last visit was to the extensive forest nursery. Here several interesting experiments are being tried as to the practical utility of manuring, but they are not sufficiently advanced for any definite opinion to be formed regarding their comparative advantages. One plot is dressed with superphosphate of lime and kainit, another with basic slag, and vetches are cultivated, the crop being dug in to enrich the soil. Two plots of Corsican pine were seen, one composed of plants raised abroad, the others at home, the plants being of the same age. The size of the former is three times that of the latter. This, however, proves nothing, except the greater care with which the plants have been reared in the foreign nursery. Corsican pine plants from the Englefield Green Nursery, on Bagshot Sand, were as fine as foreign plants. Corsican pine plants require very careful treatment in a nursery. It is better to line them out when one year old and to plant transplants in woods as soon as possible after they have been lifted from nursery lines and just before they make their spring shoots. Young nursery plants do better in woods than older ones.

In the Endsleigh nursery, larch and silver fir are grown in alternate lines, the taller larch protecting the delicate silver fir from the frost, while the shade-bearing silver fir grows well under the larch shade. The larch also benefits by the increased light space, that is afforded to it.

From this slight sketch of Tavistock woods, it is evident that only a small part of them were visited by the Society. It was impossible for us to see more in the time allotted to us, and the Society is greatly indebted to the Duke of Bedford for allowing us to visit his interesting woods, and to Mr. Rundle and Mr. Forbes for their trouble in showing us so much in a short day.

To quote a remark of Mr. J. P. Robertson: "The Duke of Bedford is setting an example, seeing our increasing imports and rapidly diminishing sources of supply, that other landlords would do well to copy. In other and less favoured parts of the country, we cannot expect the same ideal conditions of soil, climate and moisture that prevail at Tavistock for timber growing, but much can be done on the same lines."

Professor Schlich has kindly promised a much fuller account of the Tavistock woods for the next number of our Journal.

W. R. FISHER.

Notes on Practical Forestry.

A Note on the Sawfly Attacking Larch Disease in Cumberland (*Nematus Erichsonii*).

ON seeing the report of this practically new species of saw-fly attack, published by the Board of Agriculture, the writer, by kind permission of the owner, visited on the 23rd September a 200 acre plantation of larch lying in the Northern portion of the Cumberland Lake District in order to try to find evidence of the pest. The plantation has a north-east aspect, and is

completely sheltered from south-west and west winds, and is situated between 1,000 and 1,500 feet above sea level, the 1,000 feet contour line passing through the lower portion, and the 1,500 feet line passing just below the upper part of the wood.

The age of the plantation is just 60 years, and it is said to have been made at a cost of about £2 an acre. At the present time a portion of the wood is being cleared on the extreme eastern slope, and there is a good growth of grass throughout the wood on which sheep are pastured. "The grazing (of good quality) in the now rather open wood is let along with other pasture land at about 5/- an acre, and this of itself forms an increased income from what the land could possibly have yielded for pasturage in the condition it was in before planting. The well-kept estate accounts consequently prove that this compact block of plantation of about 200 acres has been a very profitable and beneficial investment to the landowner." (*Nisbet, Article on Forestry, in the Victoria County History of Cumberland, vol. ii, 1905, and reproduced in Nisbet, The Forester, vol. ii., p. 617.*)

Soon after entering the plantation at the bottom it was seen that the trees were thin in the crown, and that the tufts of leaves on the short shoots were often completely defoliated as well as the single leaves on the young "long shoots," while on searching amongst the grass by cutting away the turf below the thin crowned trees, brown and almost cylindrical cocoons of the shape usually formed by saw-fly larvæ were at once found in great numbers. Some of the cocoons had not yet been completely closed up. The larvæ coiled up within are about $\frac{3}{4}$ -inch in length, and grey in colour, due to very fine punctate markings in the skin, the back is darker grey except on the segment behind the shiny black head, which is light grey, as are also the sides of the larva. The true legs are black on the three last (distal) joints, and grey and black on the proximal portion above. The prolegs are seven pairs, and have black scattered short spines upon them.

The whole 200 acres, except where felling and peeling had taken place this last spring on the extreme eastern portion, showed the presence of the cocoons at the base of every tree examined. The grass is of value for sheep grazing, so that the

remedy advocated in the Journal of the Board of Agriculture for September, 1906 (page 375) viz., that the surface covering of the ground should be collected and burned can hardly be practicable in this case. The wood being practically mature, probably the best course is to continue the cutting it over as soon as possible. When search was made on the area where the peeled poles were lying no cocoons could be found. Naturally this would be the case, for the felling took place as the young leaves were expanding in April and May, while the caterpillar does not feed until the beginning of July.

It was interesting to observe that self-sown young larches were springing up even among knee-deep heather on the unplanted land adjoining the plantation in considerable quantity, both in the east as well as in the west. As the wood is now being felled, and the land is getting considerable stirring through the dragging of the trees down its steep slope, is it not a question whether it would not be worth while for the owner to reserve a number of trees as mother trees to obtain natural regeneration of the plantation?

Another striking observation was made that when the top of the fell was reached, over 1,500 feet above sea level, the trees, chiefly spruce as a shelter belt, were only some twelve to fifteen feet high, showing by their stunted growth, and by the direction of the flat crowns the effects of exposure to the strong south-west and west winds, while a short distance down the slope the larch were forty to fifty feet high. The stump of a felled pole standing 1,500 feet above sea level was found to girth two feet four inches.

Lower down, but still above 1,000 feet up, the girth at the middle of a fifty-five feet pole lying with its bark peeled was two feet seven inches, and of another the mean girth was one foot eleven inches.

On returning from the plantation on the other side of the road some butts of larch were lying which had been brought down from a plantation made by the father of the present owner about the same time, the old woodman who was nearing seventy years of age informing the writer that he remembered the planting being done. One girthed four feet six inches over bark, at six feet from the butt end, and another four feet eight

and a half inches, at twelve feet from the butt end. Very little increment had been put on the last twenty years in comparison with the more rapid growth for the first forty years.

J. SMITH HILL.

This sawfly was found in the larval stage by Mr. Gillanders near Rothbury, and by me in Chopwell Woods, during the past season but in small numbers only. It would seem, therefore to be widely distributed over the North of England.

In August last, Mr. Cyril F. Watson of Cockermouth, wrote me as follows :—"On one of the estates for which I am agent, there is a large tract of larch wood varying in age from 20 to 70 years, and growing on a mountain side at an altitude of from 1,000 to 1,600 feet. Two years ago, a green caterpillar with a black head made its presence known by eating the foliage of the younger trees, then by making them look quite brown instead of green. Last year the area affected increased, and this year they are all over the wood." It would appear from this letter that the attack has been increasing in the above wood for two years back, and that the presence of this sawfly may have a serious effect upon the welfare of larch plantations in the North if the above instance is repeated on a similar scale elsewhere.

A.C.F.

Timber Sales and Timber Measurements.

ALTHOUGH not quite approaching the prices of some years ago, sales of timber in this neighbourhood recently, have, on the whole, given fair satisfaction. Appended are the prices realised for one or two average lots :— LOT 1.

No. of trees	Kind.	Total cub. content	Price per foot
126	Oak	4.636 feet	1s.4d.
80	Beech	2,281 "	6d.
6	Ash	182 "	1s.
5	Elm	203 "	6d.
4	Sp. Chestnut	58 "	
1	Spruce	12 "	
1	Sycamore	6 "	
1	Cherry	3 "	

Oak, in above lot, good quality ; remainder of timber rough and of poor quality, especially beech.

Lot 2.

No. of trees	Kind	Total cub. content	Price per foot.
105	Oak	4,782 feet	1s. 3d.
20	Beech	1,906 "	9d.
40	Ash	1,961 "	1s. 3d.
2	Elm	57 "	7d.
1	Birch	12 "	6d.
1	Spruce	8 "	
1	Alder	5 "	

Oak and ash of fair quality, but a good many shaken oak, as well as bad ash butts. Beech big, but very rough.

Lot 3.

No. of trees	Kind	Total cub. content	Price per foot
90	Elm	1,455 feet	9d.
58	Oak	1,260 "	1s. 2d.
20	Ash	336 "	1s. 1d.
22	Sp. Chestnut	607 "	1s. 0d.
23	Sycamore	473 "	8d.
12	Larch	171 "	10d.
3	Beech	28 "	6d.
1	Spruce	3 "	
3	Cherry	48 "	
9	Holly	42 "	
1	Mountain Ash	6 "	

Oak, ash, elm, and sycamore in this lot of very irregular size and age.

Lot 4.

No. of trees	Kind	Total cub. content	Price per foot
60	Oak	1,421 feet	1s. 4d.
59	Elm	1,815 "	10d.
9	Ash	265 "	1s. 4d.
53	Larch	619 "	10d.
23	Sp. Chestnut	499 "	1s. 0d.
11	Sycamore	101 "	6d.
2	Spruce	29 "	
4	Birch	25 "	
1	Holly	5 "	

Similar to preceding lot, but rather better in size and quality.

All the foregoing lots were close to a good road, and about three miles distant from a railway station. Conditions of payments were 25 per cent. on completion of purchase, 25 per cent. at three months, and the balance at 1st December, 1906. All timber to be cleared by 30th September, 1906.

Each tree was carefully measured by tape, all limbs and tops down to five inches quarter-girth being included, no reduction whatever being made for bark.

I have long since found, like most foresters, that prices got for sales of timber as published in the various papers or periodicals, are, for many reasons, utterly unreliable; the chief cause being, to my mind, the different ways measurements are given or obtained. Some are purely guess work; others mere brag; in many places the old-fashioned method of using the string is still employed; and even where a tape is used for girthing, conflicting arrangements as to deduction for bark allowance occur more or less in every district, and for every kind of timber; while some measurements only include the clean butts alone; so that comparison cannot fairly be made between the prices obtained in one district and another. Besides, where a large number of trees have to be measured, the work of going over each measurement separately, and deducting a bark allowance is considerable, and often prolific of disputes.

Such at least was my experience, and caused me many years ago to adopt a method which I venture to put before my brother foresters for their consideration, as an attempt to form a universal basis for comparison of timber prices, and also to prevent a certain amount of friction between buyer and seller. The following is our standing rule:—

“All measurements to be by tape, and no allowance whatever to be made on any kind of tree for bark. All limbs and tops down to five inch quarter-girth to be considered as timber, and measured as such.”

I may say that when first I introduced this arrangement, buyers were inclined to be awkward, but it was simply a question of getting started, and for the last seventeen years every tree on this

estate has been sold without any bark allowance being deducted. No disputes as to measurement are possible, as the tape is the sole arbiter; while the selling of limbs and tops by measurement has added considerably to our revenue. Of course, where oak or larch are peeled a proportionately higher price per foot will be looked for. I may add that several young men who have received their training here, and who are now holding more or less responsible positions as foresters in various parts of the country, have also adopted this method with considerable success.

JAMES P. ROBERTSON.

Notes from Staindrop.

PLANTING.

THE planting season of 1905-1906 has been a fairly good one, with the exception of a few weeks. In early spring we had cold dry winds which did much harm to newly-planted trees, especially conifer and evergreen shrubs. When large areas are to be planted it is necessary, at times, to plant in the autumn of the year in order to push forward the planting operations, so that the work may be completed in good time in spring, but I note that the conifer and evergreen shrubs planted in the autumn have suffered more than spring planted ones. It is better, I think, to defer the planting of conifer and evergreen shrubs, if possible, until spring, especially on exposed positions. We have, this year, planted more Douglas and Scotch fir in place of larch which is suffering from *Peziza Wilkommii*, and from another disease or blight which has not yet been identified. Newly-planted nursery seedlings, since the rain, are now looking well. We have, this season, planted about 100,000 trees in the plantations.

TIMBER SALES AND PRICES.

The demand for timber this last season has been fairly good, beech being especially wanted. I have had enquiries for Horse chestnut and lime this year.

Kind.	Quarter Girt.	Distance hauled.	Price per cubic foot.	Remarks.
Ash	24½ to 6 ins.	10 miles	1s.	Tops included--inferior quality
Beech	29½ ins.	3 "	1s. 2d.	Butt only--fairly good quality
do.	17 to 4½ ins.	3 "	6½d.	Tops included--good quality
do.	26½ to 4½ ins.	3 "	8d.	" " "
Dutch Elm	22½ to 11 ins.	3 "	10d.	Good quality
Eng. Elm	24½ to 8½ ins.	3 "	9d.	Inferior quality
do. (Tops)			6d.	
Oak	24½ to 12 ins.	3 "	1s. 9d.	Good "
Sycamore	20 to 8½ ins.	3 "	1s. 3d.	" "
Birch	12 to 6½ ins.	7 "	8d.	Fair "
do.	14 to 4 ins.	7 "	3½d.	Very coarse--bad sale
Alder	12 to 6½ ins.	7 "	8d.	Fair quality.
do.	10½ to 4 ins.	7 "	3½d.	Very coarse--bad sale

Beech felled at 2s. 0d. per 40 feet.

Oak " 2s. 3d. "

Soft Wood felled at 3s. 0d. per 100 feet.

Birch and Alder " 3s. 6d. "

SOLD STANDING AND BY TENDER.

No. of Trees.	Average per tree.	Quality.	Remarks.
95 Oaks	68 cub. ft.	Fairly good	Some Oaks shaken--beyond maturity
25 Ash	42 "	Fair.	
24 Beech	55 "	Fair.	
6 Sycamore	33 "	Good	

Price realised £400, less 2½ per cent. for cash.

INSECTS.

The ravages of those insects which are most marked in this district are:—pine beetle, pine saw fly, larch aphid, spruce aphid, and the felted beech coccus.

FUNGI.

The most troublesome fungus we have here is *Pisiza Wilkommii*, and certainly it is most damaging, 80 per cent. of the larches on certain areas are affected.

In addition to the above there is another disease or blight which affects the larch, and is even more rapid in causing the death of the tree although not so widely spread. It has been said that the larch aphid might be the cause of the blight, but this, I think, is not the case, or otherwise this peculiar dying off of the larch would have been noticed before, where plantations were badly infested by the aphid. Further, trees can be found which have died in a short time and show no signs of having been attacked by the aphid.

The leading shoots and ends of top branches generally are affected first, and in some cases, trees seem to die off all at once. It has appeared in many of the plantations on the estate, even in quite small and isolated enclosures. Plantations from six to twenty years are suffering most. Some of these affected trees have been examined by experts, and they have failed to discover what is the cause of the trouble. As nothing in the shape of disease can be traced, I am led to think that it is caused by climatic influence, probably late and early frosts might be the cause. However, I may say that trees suffer both in sheltered and exposed positions. Many larch, which have suffered most, having lost their leaders and leading lateral shoots, threw out adventitious growth from the tufts of leaves, which would, under normal conditions, have existed only as tufts, but this added growth I notice in some cases has not matured, but died back. On the other hand, there are trees which have made this extra growth looking fairly fresh this spring.

ANIMALS.

Rabbits and hares are the planter's greatest enemies, and where they are preserved it is almost impossible to rear plantations without adding the enormous expense of protecting with wire-netting. i

Squirrels do a good deal of harm to coniferous trees, especially in the spring of the year. I suppose their winter store will be used up at this period, consequently the young and tender buds serve them as a food. They are also very fond of sycamore buds in early spring. j

THOMAS BEWICK.

"*Pinus Strobus*."

THE writer has not seen these pines growing at Longleat, one of the first places where they were planted in this country, but came across some fine specimens of them on the Estate of the Earl of Normanton, at Somerley, Hampshire, which he does not think could be excelled. There is a particularly fine grove in a dell near the keeper's house, sketches of which are forwarded.

He had not the means at hand of taking measurements of the trees, but they were very fine pieces of timber.

They are said to have been planted about 100 years ago by a

former owner of the property, and the example has been followed subsequently by a large number planted about twenty years ago; the planter having been clearly impressed with the growth and size of the older trees.

The timber of this tree is so largely imported that it may be a matter of interest to arboriculturists to see particularly fine specimens of it growing in this country, especially as those at Somerley appear to have escaped notice.

If the timber of the home-grown trees is as good as that imported, the *Pinus Strobus* seems worthy of the attention of the forester.

J.F.S.R.

The Effects of Different Thinnings on the Growth and Value of Young Larch Plantations.

WE have a larch plantation of eleven-and-a-half acres, planted ten years ago, and which, unfortunately, has been very much damaged in parts by rabbits.

On the occasion of its first thinning—or rather weeding out—four years ago, I thought it a good opportunity of trying the effect of different thinnings, the state of the plantation lending itself to such a course.

I divided the plantation into four sections, and since then it has been gone through twice. The following figures will show the result :—

Section.	Number of trees to acre.	Circumference at butt end.	Circumference 6 feet up stem.	Average height of trees.	Market value per 100 poles if cut.
No. 1	3327	10 ins.	8½ ins.	24 ft.	15s.
„ 2	2420	11 „	7½ „	20 „	12s.
„ 3	2117	11 „	6½ „	15 „	10s.
„ 4	1815	9½ „	6 „	13 „	8s.4d.

METHOD OF THINNING.

Owing to the strong winds to which we are subject in this neighbourhood, it is impossible for us to thin a plantation in the usual way, i.e., once in five years, or thereabouts. If we did that, as I have learned from experience, we should have a considerable

number blown. Instead, we go through, giving a part—or gentle thinning—and then follow on two years [later, in the same way. By this we get our young trees gradually brought on to stronger growth, with more root-hold. I find that plantations treated in this way will not suffer so much from gales.

LARCH DISEASE.

In this part of Cumberland there seems to have been a craze, a matter of twenty years ago, for planting whole—or nearly so—larch plantations. This craze has followed on to about ten years since, and then died out. That to my mind, is the origin of the larch disease in this neighbourhood. So far, I have not noticed it in older plantations. We have a plantation of which a third is practically useless through the disease, so badly is it affected. This we are cutting away and planting standard hardwood trees to take the place of the larch.

A rather curious fact concerning this section is, that although two years ago the disease was certainly on the increase, last year the affected parts on the trees were completely dried up, and so far this season they have shown no signs of renewed vigour.

J. ARCHIBALD.

Forestry in East Sussex.

ALTHOUGH Sussex is, for its size, the most wooded county in England, we cannot boast of much progress during the past year. There is no question that there is much greater interest taken in the subject now than in the past, but we have a long period of neglect to pay for, and new ideas are not welcomed. With better prices it is possible that more landowners would be inclined to take an active interest in forestry, and seek to improve their woodlands and estates, but with timber, bark and underwood at almost the lowest figure there is not much inducement for them.

Estate agents everywhere have complained of prices of oak this year, an all-round sale at 1/10 per foot has been the exception rather than the rule, and a large quantity has changed hands at 1/6 and 1/8; the latter figure would be about an average for good timber with easy carriage. There was a firmer demand for ash, which is not very plentiful and commands an extra penny or

twopence on oak. Larch has found a ready market, especially if quite small, and it has been possible to make 10d. and 1/- per foot, but not more, except small lots to local buyers and to meet immediate requirements for fencing contracts. A considerable amount of timber has been kept back with the hope of better times next year. The price of bark does not improve. It still pays the timber merchant to flaw to save him cost of carriage, etc., but at £2 10s. per ton, with the price of labour rising, we cannot expect it to be regarded as an industry of the future. It is very doubtful whether it pays the landlord to flaw.

We have given up complaining of the price of underwood. In many cases there is no price at all, and it is difficult to give it away. Good chestnut will still realise £3 or £4 for ten years' growth, and in the hop districts even more, whilst in Kent we hear of £15 or £20 per acre for old underwood. There is no demand for hazel, foreign competition has killed the hoop trade. Where young oak in coppice are dependent for their lives upon a clearance of the underwood periodically, it is a very serious question, and landowners would do far better if they cleared at a loss rather than continue to hold their wood with the hope of a better price, and so stifle or hopelessly weaken the young oaks.

The conversion of underwood into highwood is not making much headway. Where there is oak underwood it is possible to mark stool shoots and leave them for oak posts in the future, but the local woodmen and buyers look upon such a scheme with but little sympathy. It seems hopeless to leave stool shoots unless they be left quite close together, and this is quite contrary to all the traditions of Sussex woodmancraft. For generations we have kept our oaks far apart, so that they shall not damage the underwood, and shall form crooked stems for ship-building, and tradition says that the oak requires plenty of light and air to enable it to grow, and there is no doubt that in the vast majority of woodlands the oak has plenty of both.

Where there is no oak underwood it is difficult to get a crop of young oaks by natural regeneration on account of the rabbits. We can get an ample growth of seedlings, but unless they be carefully protected they are soon eaten off. The rabbit curse seems to be getting worse, and as long as the gamekeeper takes precedence of the agent and forester, the landowner cannot expect

much to be done in afforestation without considerable expense. On some estates now no rabbits are shot by the owner, and it is difficult to understand why they are fed year by year at such great expense.

Labour is becoming very scarce. No young men seem to be following in the footsteps of their fathers, and it seems as though there will be a serious deficiency in years to come. It is by no means unusual for woodbuyers to be unable to cut their underwood, because it has been quite impossible to find hands to do the work. For this reason we are becoming rather more bound to the timber merchant, who can keep a regular staff of men, and command gangs for felling timber.

LESLIE S. WOOD.

Third International Congress of Silviculture.

The eighth International Congress of Agriculture will be held at Vienna, in 1907, from the 21st to the 25th May. Since 1900, the International Congress of Silviculture has been held with that of Agriculture. The last Silvicultural Congress was at Rome, in 1903, and the first at Paris in 1900. Anyone wishing to attend the Congress at Vienna, or to present a report to the Congress, should address the Secretary, International Congress of Silviculture, Vienna.

The VIIIth Section of the Agricultural Congress is devoted to Forestry. Besides this section, forest education forms part of Section II. Protection against torrents and avalanches part of Section V. Forest Industries of Section VI. Protection of forest plants against diseases and injuries, and protection of insectivorous birds, and other useful wild animals, part of Section VII.

Any member of our Society can join the Congress, on application to the Secretary, Professor J. Hanoler, 6 Schauflergasse, Vienna, I.

The President of our Society and Mr. Fisher were nominated by the Council of our Society as its representatives at the Congress. The subscription payable by every member attending the Congress is twenty Austrian crowns, equivalent to 16s.8d.

Notes from Aspatia.

WE had frost here on April 30th, 1°, and on May 1st, 1½°, but none since. I have not been able to discover any damage done by it to forest trees, though plum blossom and gooseberry bushes were affected. I planted fifty Green Douglas in the Arboretum at the beginning of March, and they had a good week's rain before the droughty period came—from 18th March to the end of April—during which time only one inch of rain fell. The plants seemed to do badly from the first, and now there are only four alive. At Brayton, half an acre was planted at the same time, of Douglas, sheltered from the south-west by an older wood, but otherwise exposed. A very large proportion of them are dead. though silver fir planted at the same time have been untouched, I am, therefore, inclined to think that the plants themselves must have been out of the nursery too long, as the mortality has been so great, and I do not think the dry and frosty weather after planting was the cause.

Through the kindness of Sir Wilfrid Lawson and his agent (Mr. Thomson), an area of eight acres has this year been re-planted after a poor crop of Scotch fir, with various mixtures, to serve as demonstration plot for the College. The land was heavy drift clay, with surface drains twenty-seven to thirty feet apart. Various sections have been stocked as follows:—(1) Menzies and common spruce; (2) spruce and beech; (3) larch and beech; (4) pure larch; (5) oak and beech (or hornbeam); (6) oak, ash and beech (or hornbeam); (7) pure douglas; (8) silver fir and birch, with belts of Austrian pine on the south-east and south side, and Black Italian poplar on the south-west and west, the dampest portion.

J. SMITH HILL.

SIR HUGH BEEVOR writes that lines of three inch *Abies Pinsapo*, *Abies Cephalonica*, and *Picea Engelmanni* set out in Norfolk early in April, show how the *Picea Engelmanni* is entirely unaffected by frosts which have bitten the others and necessitated their receiving night cover.

Reviews and Extracts.

BRITISH FORESTRY.—ACTION BY THE GOVERNMENT.

REPLYING to Mr. Herbert Roberts in the House of Commons a few weeks back, Sir E. Strachey stated the steps taken to carry into effect the recommendations of the Departmental Committee of 1902 were as follows :—

1. The Departmental Committee recommended that the Alice Holt Woods, in Hampshire, should be made available as soon as possible to serve as a demonstration area in England. This has been done. A full report as to the past history, present position, and future management of these woods has been prepared by Dr. Schlich at the request of the Commissioner of Woods and Forests, and the recommendations made therein are being systematically carried out. A certain amount of experimental planting has already taken place. It was also recommended that a suitable estate should be purchased in Scotland to serve as another demonstration area. Several properties have been brought to the notice of the Commissioners of Woods and Forests, but for various reasons they did not appear suitable for the purpose. Two additional properties are now under consideration, and as soon as a suitable estate has been found the Treasury will be approached with a view to purchase.

2. The recommendation of the Departmental Committee that lecturers should be appointed at Oxford and Cambridge has to some extent been met by the augmentation of the salary of the Sibthorpe Professor of Rural Economy at Oxford, who is now Professor of Forestry Botany. It is understood that an estate will be placed at his disposal for demonstration purposes.

3. A sum of five hundred pounds a year which was placed by the Treasury at the disposal of the Board for the establishment of lectureships in forestry has been allocated to the University College of North Wales at Bangor, and the Armstrong College at Newcastle-on-Tyne. The results have been most encouraging. A considerable number of students have been found desirous of taking a full collegiate course of study, good classes of practical

foresters and others have been conducted at selected local centres, while there has been a constant demand on the part of land-owners for expert advice from the lecturer.

4. A school for working woodmen has been established by the Commissioners of Woods and Forests in the Forest of Dean, and is now in the third year of its existence. From eighteen to twenty youths are receiving instruction.

5. Legislation would be necessary to remove the inequality in the levy of the estate duty on timber, and it has not been possible hitherto to take any steps in this direction. The matter has, however, not been lost sight of.

6. The Railway Fires Act, 1905, which comes into force on January 1st, 1908, will give some protection to owners of woods against loss by fire caused by sparks from locomotives.

7. Special inquiries were made in 1905, with a view of ascertaining the extent of land now occupied by woods in Great Britain, and the results have been published in the agricultural returns for that year. The three categories suggested by the Departmental Committee were adopted.

8. With the object of ascertaining the districts in which local authorities have developed the catchment area of their water supplies by afforestation, the Board communicated with the Local Government Boards for England and Scotland, who sent out a circular letter to all local authorities asking for a return. The results were tabulated and published in the journal of the Board of Agriculture for November, 1904.

It is reported that the Armstrong College has taken over the management of Chopwell Woods, in the County of Durham, 900 acres in extent, which carry crops of larch, spruce, Scotch pine, oak, ash, and other trees, planted about fifty years ago. The woods will be gradually brought under a proper rotation of cropping by the clearing and replanting of the more mature portions from time to time, and the carrying out of this work will afford favourable opportunities for demonstrating the various operations relating to forestry.

Timber Trades Journal.

FORESTRY AT OXFORD.

THE following Annual Report of the Delegacy for Superintending the Instruction of Probationers for the Indian Forest Service and for granting Diplomas in Forestry (for the year 1905) will be presented to the House :—

Previous to the commencement of Michaelmas Term, 1905, an arrangement was made between the Secretary of State for India and the University of Oxford, by which the education of Probationers for service in the Indian Forest Department was transferred from the Royal Indian Engineering College, Coopers Hill, to the University of Oxford.

Under this arrangement, the Secretary of State for India agreed to render for three years the following assistance :—

- (1) To transfer the Government Professor of Forestry and the Assistant Professor of Forestry from Coopers Hill College to Oxford.
- (2) To contribute the sum of £200 annually towards meeting the pay of a Demonstrator in the Geological Department, and for other purposes.
- (3) To contribute £100 a year towards the establishment and maintenance of a Forest Garden.
- (4) To pay the rent of a house required for the instruction of the Forestry Students and the storing of the collections.

The University, on the other hand, agreed to provide the necessary instruction in subjects auxiliary to Forestry, and more especially in Forest Botany, by re-establishing the Sibthorpiian Professorship.

As a consequence of this agreement, a Delegacy for Superintending the Instruction of Probationers for the Indian Forest Service and for granting Diplomas in Forestry was instituted, consisting of the Vice-Chancellor and Proctors, the Sherardian Professor of Botany, the Sibthorpiian Professor of Rural Economy, the Professor of Forestry, six members of Convocation, and one or more persons appointed by His Majesty's Secretary of State for India.

The Delegacy met for the first time on October 20, 1905, and appointed Mr. Schlich Secretary to the Delegacy, and Mr. D. H. Nagel Assistant Secretary.

Regulations for the Diploma in Forestry were considered by the Delegates at their second meeting and passed. The Regulations give the course of study laid down for Forestry Students, and the manner in which the Diploma in Forestry can be obtained. They are published in the *Oxford University Gazette* of April 7, 1906, and copies in pamphlet form can be obtained at the Clarendon Press Depot, 116 High Street, Oxford (price 6d.).

Instruction was given during Michaelmas Term in various branches of Forestry by Mr. Schlich and Mr. Fisher, in Botany by Professor Vines and Mr. Church, in Geology by Professor Sollas and Mr. Douglas, in Entomology by Professor Weldon and Mr. Grosvenor.

Pending the appointment of a Sibthorpian Professor, arrangements have been made for courses of instruction on Plant Pathology and the Structure of Timber by Dr. P. Groom, and on Systematic Botany of Indian Trees and Shrubs by Mr. Duthie, formerly Superintendent of the Botanic Garden at Saharanpur. Mr. N. F. Mackenzie has been appointed to lecture on Surveying and Forest Engineering.

Attendance.

The number of Students during Michaelmas Term, 1905, was as follows :—

- (1) 13 Students were brought over from the Royal Indian Engineering College, Coopers Hill. These have pursued an approved course of study of one year at Coopers Hill, and are studying for a second year at Oxford, before they proceed to a practical course on the Continent.
- (2) 17 Students joined in October and November, namely—
 - 14 Probationers for service in India.
 - 1 Probationer for service in the Soudan.
 - 2 Students sent by His Highness the Maharajah of Mysore.

The total number of Students at Oxford is thus thirty. In addition, nine third-year Students are pursuing a course of practical work in Germany and Switzerland. With these the Delegacy has, however, no concern, as they left for the Continent direct from Coopers Hill.

Accommodation.

A small house, 6 Keble Road, has been rented, containing a lecture-room (for 18 Students), as well as accommodation for part of the collections and the Forest Library brought from Coopers Hill. The greater part of the collections is, however, stored in the University Museum. The use of a larger lecture-room has also been placed at the disposal of the Delegacy at certain hours in the week by the Professor of Geology. These arrangements just suffice to start with, but they involve great inconvenience. A permanent home for the Forestry branch of the University is urgently required. It is hoped that early arrangements will be made to provide a separate establishment, containing two lecture-rooms (one for twenty and one for forty Students), a museum, laboratory, and a Professor's room.

Forest Garden.

The authorities of St. John's College have very kindly given to the Delegacy the use of sufficient land in Bagley Wood for the establishment of a Forest Garden, where nursery work can be carried on and small experimental plantations of economically important timber trees laid out. Good progress has been made, and work is steadily proceeding.

An Arboretum is being established by the Royal English Arboricultural Society, on land at Tubney, belonging to Magdalen College. Although this has no direct connexion with the Delegacy, it will be useful in many ways for the instruction of the Students in Forest Botany.

From *Oxford University Gazette*.

THE SOUTH AFRICAN SCHOOL OF FORESTRY.

THE South African School of Forestry is being established by the Government of Cape Colony for the scientific training of Forest Officers and for research in South African Forestry. The aim of the school is to provide a thorough course of instruction in forestry with special reference to South African conditions.

Provision is being made for ten resident students at Tokai. Five of these will be candidates for two Cape Forest vacancies in

the upper grade of forest officers, and accommodation will be reserved for five students nominated by the Government of other colonies in South Africa.

The science departments of the South African College and any other similarly equipped college in the colony will be used for the theoretical work of the School of Forestry, while a reading room and reference forest library will be provided for students at Tokai.

The herbarium at the Conservator's office, and the forest timber collections both at the Conservator's office and at Tokai will be available for purposes of instruction. The Tokai arboretum, which now comprises the largest collection of timber trees in South Africa, affords unique opportunities for practical instruction in silviculture. To this will be added the pineries and sand-reclamation planting in the Cape Flats, together with the fine Arboreta and forests at Ceres Road, comprising forest estates of 20,000 acres. Such instruments as are required for practical forest work, including plane tables, barometers, chains, dendrometers, and calipers will be provided.

Arrangements will be made for granting certificates or diplomas signed by the Senate or Council of the College concerned, and countersigned by the Chief Conservator of Forests on behalf of the Government, to students who have satisfactorily completed the course in forestry.

The boarding arrangements at Tokai will be in charge of the Conservator of Forests, Western Conservancy, and under the management of the local Superintendent of Plantations. The inclusive charges for board, etc., are £13 10s. per term; every student will be required to pay an entrance fee of £5 to cover provision of bed linen, table linen, etc.

The School of Forestry opened on February 26th. The present course extends over two years, and comprises practical work at Tokai, where the students live, and lectures at the South African College on Forestry, by Messrs. Hutchins and Wilmot, of the Forest Department, and on Botany, Geology, Surveying, etc., by the various professors of the South African College. Intending students may enter at any time up to May 7th. There is boarding accommodation at Tokai for ten students. Two appointments in the superior grade of the Forest Department are offered for competition to those now entering the Forest School.

These appointments are open to all British subjects who are of good physique, and of sufficient educational attainments to profit by the course of instruction at the Forest School. The names of candidates who may have done well at the Forest School, but not succeeded in obtaining one of these two appointments will be entered as eligible for other forest appointments. The total cost of the training at the South African Forest School is stated at £250. This includes charges for board, lodging, school fees, and the forest tours which are arranged for the conclusion of the course. Those who are not able to follow the whole forest course may enter as "partial-course" students, and follow such lectures and practical training as they desire. Such partial-course students will naturally not be able to compete for the Government appointment, nor to qualify for the diploma in Forestry, but their names will be entered as eligible for minor forest appointments as vacancies arise. It should be mentioned also that for those who are not sufficiently grounded in elementary science to enter the Forest School now, there is a preliminary Forest course beginning in February, 1907.

The utility of a South African Forest School will be readily perceived when it is considered that Cape Colony has up to now spent over £1,000,000 on forestry (reckoning interest at $3\frac{1}{2}$ per cent.), and owns forest estates which are estimated to-day as worth £2,000,000, and which, when brought up to their full yielding capacity, will be worth £10,000,000, for they will then produce in Cape Colony all the timber now imported at such a ruinous cost from distant countries. Cape Colony now pays on an average about £500,000 for imported timber, while the total South African timber bill is computed to average not less than a million and a half pounds sterling yearly. For some years past it has been the practice to send Cape Forest students to Europe, and latterly to America. Now, like the Japanese, we are in a position to train men at home. The forestry taught at the South African School of Forestry will be extra-tropical forestry, as distinguished from the forestry of cold temperate countries (taught in Europe and North America), and from tropical forestry taught at Dehra Dun, India.

From Cape Times.

* "EXOTIC FOREST & PARK TREES FOR EUROPE."

By Dr. H. Mayr.

THIS recent work of Dr. Mayr's, of Munich, is a wonderful contribution to the practical side of arboriculture and sylviculture in their relation to exotic trees. Dr. Mayr's extensive travels, and his wide experience of scientific forestry, enable him not only to discuss the intrinsic merits of various species in their native countries, but also to form fairly accurate opinions as to their value for timber growing when introduced into Europe. His remarks on this point, which accompany the description of almost every species enumerated, invest the book with a special interest and value for European foresters, although the arboriculturist benefits from the appearance of the work to probably a greater extent than the economic forester, so numerous are the species dealt with both in the illustrations and text.

The contents of the book are divided into two main sections, one dealing with the forest districts and regions of various parts of the world, and the other with the acclimatization and description of the various genera and species of coniferous and broad-leaved trees which are capable of existing in Europe.

To thoroughly review this book in a satisfactory manner is almost impossible, as its interest to foresters in general lies in the comments which the author makes upon numbers of species which are regarded as more or less possible trees for profitable planting in this country. The chapter devoted to acclimatization is also of great interest, as the author is probably the greatest authority, so far as forest trees are concerned, on this subject in Germany. We must content ourselves, however, with giving the substance of Dr. Mayr's opinions on a few subjects which are of special interest to British foresters.

Dr. Mayr considers that there can be no question of acclimatization unless the climate to which the tree is introduced is essentially different from that of its home, and that the subject can only be properly discussed and studied when the climates of both countries are thoroughly understood. The non-success of an exotic species is often attributed to climate, when it may possibly be due to dozens of different causes, and which are likely to effect

* *Fremdländische Wald-und-Parkbäume für Europa.* Paul Parey, Berlin.

individual trees. As regards temperature, the author considers winter cold quite as important in many instances as summer heat, and species which are accustomed to low winter temperatures may fail when introduced to a climate with mild and almost frost-free winters.

As a case in point, the spruce may be cited, as this tree rarely thrives where the winters are mild and dry, although humidity rather than temperature would appear to be the important factor in the development of this tree.

Another dictum of the author's is that practically all species of a genus agree as regards the quality of their wood, and that the idea that an introduced species may possibly produce better timber than its indigenous representative, is erroneous. To the practical forester, the important point lies often less in the quality of the wood, than in the habit and character of growth of the tree. So far as one can see, the quality of the wood of Austrian pine is as good as that of Corsican as regards density and durability, but the characters of the two trees differ sufficiently to render one almost worthless, and the other of great value for timber production.

Dr. Mayr gives copious directions and plans for the guidance of the intending planter of exotic trees, all of which are worth careful consideration. But it is necessary to distinguish between the sharply defined Continental climate of Germany and the insular climate of Great Britain in dealing with these points. For instance, Dr. Mayr has constructed a number of groups of species arranged according to the climatic zones or regions in which they may be expected to thrive, such as the *Fagetum*, *Castanetum*, etc. We doubt very much, however, whether the British tree planter would find these lists of much use to him, or would be justified in assuming that the existence of a healthy beech or chestnut would indicate the suitability or otherwise of the situation for the whole of the species included in the author's respective groups.

The most valuable portion of the book is that devoted to the botanical description and illustration, and account of natural habitat, of the numerous species capable of living in Europe, and from which extracts are given in the article on "The Larch Disease" (page 38). These descriptions are accompanied by

cultural notes relating to the author's collection of exotic trees at Grafrath, near Munich. Sets of illustrations showing the form of buds, leaves, microscopic structure of woods, etc., are given at the end of the book, which are exceedingly useful for reference.

A.C.F.

"TREES OF GREAT BRITAIN AND IRELAND."

A PROSPECTUS of the great work upon which Messrs. H. J. Elwes and Henry have been engaged for several years has been received. This work is to be issued in five volumes, the price of each being £3 3s., and as only a limited number of copies are to be printed, they are not likely to lose their value as time goes on. The high cost of this work lies in the superb illustrations which accompany the letterpress, and the exhaustive enquiries which have been personally conducted by the authors in every part of Great Britain. When completed, it will not only form the most authoritative work on British trees, both indigenous and introduced, but will certainly rank with the best of its kind in existence. It is, of course, beyond the reach of the average British forester, but that is the latter's misfortune.

Intending subscribers should communicate with Mr. J. Edwards, Colesborne, Cheltenham, and from whom copies of the prospectus may be obtained.

WEBSTER'S FORESTERS' DIARY.

A COPY of this useful Diary for 1907 has been received. It contains various items of information which the forester is likely to require at one time or another in the course of a year's work, but which cannot be carried in the head without a tenacious memory. It can be carried in the pocket without inconvenience, and is published by W. Rider & Son, Limited, 164 Aldersgate Street, London, at 2/6.

TRANSACTIONS OF
The Royal
English Arboricultural Society

Summer Meeting in Devonshire.

SUMMER MEETING AND DINNER.

THE Summer Meeting of the Royal English Arboricultural Society was this year, for the first time, held in Devonshire, a county famed for its beautiful scenery. The proceedings extended over three days, and proved, in every respect, highly successful. As regards weather it was, but for occasional showers, every thing that could be desired. The members made the New London Hotel, Exeter, their headquarters, and arrived there on Tuesday evening, August 14th.

THE MEMBERS AT BICTON.

The programme for Wednesday, was a visit to Bicton, the seat of the Hon. Mark Rolle, and the Annual Meeting.

The members were early astir. They had breakfast at 7-30 a.m., and shortly after eight o'clock the drive to Bicton, in brakes, was commenced. The journey, which was much enjoyed, was by way of Clyst St. Mary and Woodbury Castle. On reaching the principal lodge at Bicton, the members were received by Mr. E. F. Chamier (agent), Mr. John Muirhead (forester), and Mr. Mayne, (head gardener), and were each furnished with a neatly arranged catalogue of coniferæ in the pinetum.

Before proceeding further, a word or two respecting Bicton may prove interesting. Bicton was given by Henry the First to one John, surnamed Janitor from his office, and the tenure by which the estate was held was that of keeping the prison for the County. The County gaol was in the parish till the year 1518, when it was removed to Exeter, but the Lord of Bicton was not exonerated from the custody of prisoners till 1787. From the Janitors, Bicton descended through the families of Arblaster, Hampton, Sachville, and Copleston, to Sir Thomas Dennys, whose great grand-daughter conveyed it by marriage to Sir Henry Rolle of Stevenstone, Devon, early in the reign of James the First. The mansion was built in the latter part of the 18th century, by Dennys Rolle, of Hudscott, North Devon, who inherited Bicton from his brother John, who died in 1779 without issue. Dennys Rolle, a man

of great abilities and a great botanist, imported many varieties of trees from America to Hudscott, and during his lifetime, and that of his son, John Lord Rolle, the present grounds of Bicton were planned and partially carried out, being completed by Lord Rolle's widow, the late Lady Rolle. The gardens were re-modelled, the lake made, and the arboretum begun in the early days of the 19th century, under the supervision of Mr. Glendenning, of Chiswick, and brought to great perfection under the late Mr. James Barnes.

At Bicton there is, to say the least, a charming variety of trees, and some magnificent specimens. The *Araucaria* avenue was planted in 1842-3, and interest in it is greatly enhanced when it is pointed out that it is about the only one known in which is to be found a male and female specimen. The girths of a few of the finest specimens, taken about four feet above ground, range from 9ft. 0 $\frac{3}{4}$ in. to 7ft. 0 $\frac{3}{4}$ in. Appended are the girths of some of the largest trees inspected during the tour of the estate:—Elm, 22ft. 6in.; Beech, in Arboretum, 16ft. $\frac{1}{2}$ in.; *Abies Douglasii*, in Rosary, 12ft. 5 $\frac{1}{2}$ ins.; *Pinus Insignis*, 17ft. 7 $\frac{1}{2}$ ins.; *Abies Douglasii*, 13ft. 4ins.; *Abies Menziesii*, 12ft. 7 $\frac{1}{2}$ ins.; *Abies Cephalonica*, 16ft.; *Cupressus Macrocarpa*, 13ft. 8 $\frac{1}{2}$ ins.; *Cedrus Deodara*, 8ft. 9ins.; Lime, on garden bank, 13ft. 8ins.; *Abies Morinda*, in garden, 12ft. 2ins.; *Cedrus Deodara*, 12ft. 7 $\frac{3}{4}$ ins.; Poplar, in garden, 19ft. 9 $\frac{1}{4}$ ins.; old Oak, near Flint Lodge, 24ft. 11ins., and *Cedrus Libani*. *Araucaria* avenue, 21ft. 8 $\frac{1}{2}$ ins.

The visitors were conducted through the gardens, which were looking simply delightful.

The members were entertained at luncheon at the House at the invitation of the Hon. Mark Rolle, who telegraphed from Scotland, tendering a cordial welcome to the members of the Society to Bicton.

The PRESIDENT (Professor Fisher) said it was his duty and pleasure to propose the health of the owner of the fine estate they had had the opportunity of visiting that day. (Applause). It was not the only favour they had received from the Hon. Mark Rolle to have seen his beautiful woods, etc., but they had already received from him some fine sample specimens of coniferæ. (Applause). They were presented to the Society, and he was pleased to inform the members they were thriving splendidly. (Applause). Hardly any of them had been lost,

although the roots of a few had been affected owing to being sent to various shows. He had now had them under his charge for two years. They were now planted about six miles from Oxford, and the whole collection was intact and growing vigorously. (Applause). Permission had been granted them by Magdalen College, Oxford, to plant them, when large enough, to start an Arboretum for Oxford, and he believed the commencement of the plantation would be made in the present autumn. As regards the beautiful County of Devon, they had that day seen a portion of it under most favourable conditions, and he believed anything would grow in it. (Hear, hear). They had, however, seen one thing which they would like to see remedied, viz., an enormous area of waste land. (Hear, hear). Unfortunately, waste land was common land, and he did not think commoners were getting much out of it. If stocked with beech and Scotch pine it would produce a large quantity of wood and labour for the people, which would certainly keep them on the country side. (Applause). He thought they noticed as they drove along that the population was scanty. He thanked the owner of the estate for the reception accorded to the members of the Society, and coupled with the toast the name of Mr. Chamier, who had so kindly assisted them, and the forester and head gardener, who had conducted them over the estate. (Applause).

Mr. CHAMIER, who presided, remarked that he was commissioned by the Hon. Mark Rolle to extend to them a hearty welcome to Bicton, and to express his great regret that, owing to his not being in a good state of health, he was unable to receive them in person. There was no need to tell them, especially after what the President had said, that Mr. Rolle's interest in the objects which the Society had at heart was very keen. (Applause). He had been told that the members of the Society had that day seen some trees such as they had never seen growing in England before. (Hear, hear). In conclusion, Mr. Chamier acknowledged his indebtedness to Mr. Muirhead, whose work, he said, was appreciated both by Mr. Rolle and himself, and to Mr. Mayne, whose excellent work they had seen in the ornamental gardens, and whose name was a household

one all round that portion of Devonshire. He also acknowledged the services of Mr. Barrie, the forester at Stevenstone. (Applause).

The return journey to Exeter was by way of Woodbury village and Topsham, a pretty drive.

VISIT TO POLTIMORE AND KILLERTON.

As on the previous morning, the members had breakfast at 7-30, and left the hotel, in brakes, shortly after eight for Poltimore Park and Killerton, the charming estates of Lord Poltimore and Sir Thomas D. Acland, respectively.

At Poltimore the party were met by Mr. T. H. Slade, the head gardener. The President was received by Lord Poltimore. One of the most interesting features here was the avenue of trees in which some splendid specimens were seen. The dimensions of one *Wellingtonia gigantea* inspected, planted about 1854, were: height, 100ft.; girth, 17ft. 3ins.

At Killerton the members were received by Mr. Wm. Stevens, agent, and Mr. Coutts, head gardener. Sir Thomas Acland regretted that he could not receive the visitors in person. Telegraphing from Porlock to Mr. Stevens, Sir Thomas said: "Lady Acland and I are sorry not to be with you to-day. Hope your weather is better than ours." Mr. Stevens handed the telegram to the President, who read it aloud to the members. The message was well received.

The woods and gardens were greatly admired. Referring to one magnificent specimen of oak, the President defied anyone to find a more valuable piece.

At the kind invitation of Sir Thomas Acland, the members were entertained at luncheon, served in a marquee erected on the lawn near the house.

The PRESIDENT, in proposing the health of the host, remarked that the name of Acland was one which, perhaps, had for more than a century been respected more than any other in the county. (Applause). There was no man more anxious to further the cause they had at heart, and he knew of no two places where trees grew in such a healthy state, and to such a great size, as at Bicton and Killerton. (Applause).

Mr. STEVENS, in responding to the toast cordially received, read the following interesting letter from Sir Thomas Acland :

“ Holnicote,

“ Taunton, 15th August, 1906.

“ Mr. Stevens,—As you will no doubt have some opportunity to-morrow, I hope you will explain to the members of the Royal English Arboricultural Society my great regret at being unable to meet them, in consequence of having long ago promised to open a new school, recently built, in North Devon, where the arrangements had all been made on a day chosen by myself some weeks before I heard of the desire of the Society to visit Killerton. I am anxious that they should appreciate the fact that when my father was nine years old (1818) the pleasure ground was still open park, and the only trees that I know existed then of any special interest now in the grounds were the tulip tree, the Scotch fir and the oak near it, and of course the Luccombe oak near the kitchen garden. The chestnut below the chapel, near the larch, was planted when my father was born. I hope they will see the stone pines in Taverner field, and also those in the wood near the plain of the park. I wish I could have gone round with them myself. I hope they will have fine weather.

“ Yours faithfully,

“ T. D. ACLAND.”

Mr. Stevens continuing, said there were 900 acres of woods at Killerton, 700 acres of which were planted by the tenth Baronet. The system followed on the estate in the way of plantations was that all other trees in their turn should give place to the oak, and he believed it was the intention of the present Sir Thomas Acland that this system should continue. Sir Thomas, as a farmer, was very keen on orchard culture, and in connexion with the system of treatment of the trees, it was believed that much good had been done by removing the grass and loosening the earth round the stems for some two or three feet. In conclusion, Mr. Stevens congratulated the members on the useful work being done by the Society, ample evidence of which was found in the record of the *Transactions* of the Society.

The **PRESIDENT** remarked that until that day he had no idea that most of the trees they had seen were planted in the lifetime of one man.

On returning to Exeter the visitors inspected the Guildhall, Cathedral, and Museum. At the latter place was seen an interesting collection of wood sections presented by the Hon. Mark Rolle, and which was specially exhibited for the Society by the Museum Authorities and Mr. James Barrie.

The Mayor (Councillor T. Linscott) and the Sheriff (Councillor T. Bradley Rowe), who were accompanied by the Mayoress and Sherifina (Mrs. Linscott and Mrs. Bradley Rowe), received the party at the Guildhall, and entertained them at tea.

The **MAYOR**, addressing those present from the Aldermanic bench, said it afforded him great pleasure to receive the members of the Society in that old hall. (Applause). He was delighted to see such a large number present, and expressed the hope that during the time they had been in Devonshire the scenery and various trees, etc., they had seen had been a source of gratification to them. (Applause).

The **SHERIFF** remarked that he was extremely pleased in being able to join with the Mayor in welcoming to the city such a distinguished body of men, who had such an excellent work in hand. They were assembled that day in a 13th century building, and the regalia, etc., to be seen in it he was sure they would find attractive. (Applause).

An interesting description of the old paintings on the walls and the city regalia was then given by one of the mace sergeants, after which the **PRESIDENT** of the Society (Mr. Elwes), who, with other members, accompanied the Mayor and Sheriff on the Aldermanic bench, said he was sure all the members would agree with him that they were indebted to the Mayor, and Sheriff, and the Corporation for the hospitality accorded them. (Applause). Of the Council chambers he had seen in England, he had never seen one so interesting as the one in which they were now assembled, and he congratulated the city on such an admirable place. (Applause).

The **MAYOR** thanked the President for his complimentary remarks.

The company then partook of tea, following which they were shown over the Cathedral by the Rev. Chancellor Edmonds.

THE ANNUAL DINNER.

The Annual Dinner, held at the headquarters, the New London Hotel, in the evening, proved an enjoyable function. The President presided, and the visitors present included the Mayor and Sheriff, wearing their chains of office, Mr. E. F. Chamier (agent to the Hon. Mark Rolle), and Major Gratwicke, of Exeter (President of the Institute of Journalists).

Communications were received from His Grace the Duke of Bedford, Lord Fortescue, Lord Poltimore, Sir Thomas D. Acland, the Hon. Mark Rolle, Mr. E. C. Rundle (Agent to His Grace the Duke of Bedford), and Mr. William Stevens, of Killerton, regretting inability to be present.

The PRESIDENT, in proposing the toast of "The King," said His Majesty was a forester, and he knew that he showed a great deal more interest in their subject than perhaps any King before him. (Applause). The toast was patriotically honoured, as also was that of "The Queen, the Prince and Princess of Wales and other members of the Royal Family."

Mr. GRAY proposed "The Mayor and Corporation of Exeter." He said he felt the toast was one which might have been given to one who, in proposing it, could more fully have expressed the respect and esteem which the members of the Arboricultural Society felt for the courtesy extended to them by the Mayor and Corporation that day. He was sure they all esteemed highly the great kindness the Mayor and Sheriff showed them in inviting them to the historic Guildhall, and for their presence that evening. (Applause). As one who, for twelve years, knew something of municipal work, he felt certain that the Mayor and Corporation of Exeter were doing some worthy deeds. He was pleased to see in Exeter signs of great progress. The streets, the open places, parks, and gardens spoke of municipal care, sympathy and interest, and he felt sure for a city with all this the Arboricultural Society would feel the utmost regard and sympathy. (Applause).

The MAYOR, in responding to the toast, which was well received, assured the company that it was a great pleasure to

the Sheriff and himself to have been able to receive the members of the Society, in the Guildhall, and to be present at the annual dinner. (Applause). He hoped their visit to Devon had led them to the conclusion that it was a magnificent county. (Applause.) In visiting Bicton, Killerton, and Poltimore Park they had no doubt been impressed with the grand characteristic of tree life. He, however, felt that although some magnificent trees were to be seen on the various country estates in the county, their visit to Devon would have a lasting effect on the landed proprietary that tree life should be studied. He understood that the Arboricultural Society—the existence of which he did not think he knew of until recently—now had a membership of over 800. He considered this creditable, and hoped that before the Society had reached another twenty-three years' existence, which he understood it had now done, the membership will have grown to five or six thousand, and that by that time the study of tree life will have permeated into the hearts of the landed proprietary and the next generation see the benefit of their work. (Applause).

The SHERIFF also replied. He felt honoured in being able to speak to a body of men who, no doubt, had as big a work before them as any municipality had; men who were working not for their own benefit, but for those to come after them. With regard to Exeter he believed the members of the Council were doing their best for the municipality. (Hear, hear). They were proud of their city, and were pleased to welcome in the old Guildhall the members of the Arboricultural Society. (Applause).

Mr. E. R. PRATT, of Ryston Hall, Downham, proposed the health of the "Proprietors of the estates visited by the members and the proprietors of the estates they were invited to visit." In doing so he said there were a great many varieties of landowners in the country. One class was those who came into old acres, and, as an old landlord himself, he welcomed them, believing they would bring money and prosperity to the cottagers. (Hear, hear.) Landowners must of course have

their game. Game in England was now a source of income to the landowners. At the same time they should ask the new men, with their money, to prefer good agriculture, well cultivated fields, and well managed forests to excess of game. (Hear, hear). Another class of landowner were old men and the old acres; men who had served their county, built cottages and homesteads, constructed beautiful woods, and planted beautiful trees, such as they had seen during the past two days. This was the class of men whose health he had the honour to propose that evening; men who loved the land and trees, and desired to leave their estates in a better condition than they found them. He wished them all health and happiness. (Applause). Continuing, Mr. Pratt said that before they commenced to discuss silviculture from a commercial standpoint, it was necessary for them to consider their position and ask themselves what it would be in the future? When our forefathers planted their forests there was no taxation on woods. Therefore, the possibility of making an income out of woods was greater than now. Woods, as they all knew, were now rated on what was termed their natural and unimproved value, and which was generally held to work out—he was not speaking of the poorer land in the North of England—at 12s.6d. per acre. It must be remembered they were more heavily taxed than farmers, and he maintained that as silviculture was nothing more nor less than a form of agriculture, it should be treated in the same way as agriculture. (Hear, hear). If the farmer had, with difficulty, to compete against oversea trade they had to do exactly the same thing with regard to timber. He understood it to be said that if the Society was to progress they must begin to plant woods. What he asked, however, was, whether before they commenced to plant woods, they could not approach the Government in order to see whether they could not secure some consideration for their produce as competing against oversea trades. There should be some way of making certain, that after planting, their assessment would not be unduly raised, and their profits taken away. (Hear, hear). No one knew until he tried what could be done by enterprise, and it was only right they should protect their industry in every legitimate way they could. (Applause). It afforded him great pleasure to propose the

health of His Grace the Duke of Bedford, Lord Poltimore, Sir Thomas Acland, the Hon. Mark Rolle, and the Earl of Devon, who had invited the members to visit Powderham Castle on the Saturday. (Applause).

Mr. CHAMIER, in responding, said he felt sure it was only circumstances over which they had no control that had kept the proprietors named away that evening. Further, he assured the company that so far as the Hon. Mark Rolle was concerned, and he believed the same remark would apply to the other gentlemen, he regarded the visit of the Society to his estate as a great honour. As regards silviculture from a commercial standpoint, it had been recognised for some time past by landowners that it did offer most likely prospects, and they looked forward with hope to the work of the Arboricultural Society to assist them greatly. They recognised gratefully what science had brought to bear on the matter. Science and practice went together, one not being of much use without the other. (Applause).

The PRESIDENT gave "The Visitors." One of them, he remarked, had informed them that until recently he had never heard of the Arboricultural Society. He hoped the members would not regard this as a slur upon the Society, because they must remember that the Society came from the North, and that they were in the extreme south of England, except Cornwall. But, in addition to that, the members of the Society had preferred to work rather than talk. (Hear, hear). His idea of the functions of the Society was that members should acquire that intimate knowledge of the habit, etc., of trees, which would enable them to judge what trees to plant and how to plant them. It must always be a problematical question as to what was going to be the result of any plant. They could have no conception of what value the trees would be when the forest was laid, and, although he firmly believed that whatever fell in price, timber must go up as time went on, there must be a great deal of risk about it. What he looked upon as a function of the Society was the education of the rising generation, landowners, landagents and foresters, in such a way that they would apply correct scientific principles in a practical manner, and always be guided by the local experience. He did not think any man, however clever he might be, should dictate

to people what they should do in districts with which they were closely acquainted. He desired their visitors to realise what the Society was trying to do, and how anxious they were that the work should be known in the uttermost parts of England. (Applause). There was, perhaps, no part of England where the climate and soil were so favourable for trees as in Devon, and it was evident from what he knew of the fine places in the neighbourhood of Exeter that arboriculture had been a principal delight of many of the owners of property, including those whose estates they had seen and had been invited to see. (Hear, hear). When Exeter was suggested as the place for the summer meeting, he (the President) said there was no other neighbourhood in England, of a radius of fifteen miles, where so many exotic trees, and such a variety, could be found as in the neighbourhood of Exeter. (Hear, hear). Take Bicton for instance. They might put a botanist there for six months, and then he would be unable to tell them all about the trees in that one place. Then there was Endsleigh and a number of places in North Devon quite as interesting, and if they asked him to select what he thought the most arboricultural place in the whole of Great Britain, his answer would be that around Exeter came before any centre he could tell them. (Hear, hear). He did not know whether their visitors realised the exceptionally fortunate position they were in, but he thought they would do if they knew the terribly different conditions they had to fight against, including climate. He hoped they would go away feeling that the members of the Society would leave the county impressed with the extraordinary position in which Nature had placed them, and they hoped that landowners and future landowners would continue the practice of their forefathers, and not allow, in connection with tree life, the reputation that Devon had gained to fade in any degree. (Applause). It had given the members of the Society great pleasure to receive the visitors present that evening, and if they would use their influence to obtain for the Society a large number of new members in the county, they would be welcomed. (Applause). He did not think the number belonging to the Society from the extreme western counties was so large as it should be. Therefore, he hoped the visitors would go away and tell Devonians that the Society was to be encouraged. (Applause). He

coupled with the toast the name of Major Gratwicke, who, he said, he understood to be connected with the principal newspaper in the county. This being so, it would be unnecessary to propose the toast of the Press separately. No other body had so much power in their hands, or could use it to so much advantage, as could the Press. Personally, however, he did not think many gentlemen of the Press realised as they might what an important subject arboriculture was. In America the timber trade was the third greatest industry, and if they looked at the woods and forests in England, and considered from a commercial standpoint what an enormous opportunity was offered, he thought a greater space might be devoted to the subject in the newspapers than was at present the case. (Hear, hear).

Major GRATWICKE, in reply, said he was sure he might say on behalf of the other visitors, as well as for himself, that they were delighted to have been present that evening, and were delighted that the Society had chosen Devonshire for its summer meeting. (Applause). Visitors were always welcome in Devonshire, and an endeavour was always made to make the visits pleasant, with the hope that they might return again. (Applause). As regards his name being coupled with the toast, it was rather difficult to see what connection there could be between so prosaic a business as the production of a newspaper and so charming a science as that of forestry. Yet after all the world was small; they were all, in a measure, dependent one upon another, and he confessed he had discovered a connection. The difficult position they would have been in but for forestry may not have struck them. Almost every sheet of paper from which they read came from the tree. It was wood pure and simple, and so easily manipulated that he recollected being in a paper mill the other day and finding they wanted to reduce the size of a somewhat enormous reel—it was simply sawn in half! His friend, Mr. Smyth-Osbourne, who, with his characteristic hospitality asked him to attend the dinner, said there might be another connection why his name should have been associated with the toast. That was because a short time since he (Major Gratwicke) was in a country where, perhaps, there was more wood than in any other country in Europe. He referred to Sweden, and he thought it would be very

interesting if the Arboricultural Society held one of its summer meetings in that country. He assured the members they would find there most hospitable people, and everything up to date. Further, they would find more than one half of the country covered with timber. Forestry, in addition to being an interesting science, might be made remunerative, and if the visit of the Society to Devonshire was the means of leading some of the common land in the county to be planted with trees, and to produce in the future some such result as was found in the country to which he had alluded, the visit of the Society to Devon would have been of material advantage to the county, and would be long remembered. It had been said that not much had been heard of the Arboricultural Society in that part of the country. The President said they desired the Society known to the uttermost ends of the earth. They could easily attain that object. He (Major Gratwicke) was a newspaper man, and they would be delighted, on the usual terms (laughter) to place at their disposal as much of their space as reason would permit to make the objects and purposes of the Society known, and he had no doubt that if some such step was taken, they would secure what they desired—an addition to the membership. In conclusion, he thanked the members for their generous hospitality and the compliment paid them as visitors, and he ventured on their behalf, to express the hope that their first visit to Devon, would not be the last. He was sure they would be welcomed by all grades of society to the county in which they were proud to live. (Applause).

During the evening some pleasing vocal contributions were given by a quartette party consisting of Messrs. A. Norman Kendall, Ernest Tremmett, Robert Courthey, and A. J. Macey (Torquay).

VISIT TO ENDSLEIGH.

On Friday, the concluding day of the meeting, the members left Queen Street Station (London and South Western Railway) by the 7 a.m. train for Tavistock. The party travelled in reserved saloon carriages, and the scenery en-route, including portions of Dartmoor, was much admired. At Tavistock, which was reached shortly before nine o'clock, char-a-bancs were waiting to convey the visitors to Endsleigh, the magnificent

and extensive estate of His Grace the Duke of Bedford. Mr. E. C. Rundle (Agent to His Grace), and Mr. R. G. Forbes (forester) were present to conduct the party in their tour. The greater portion of the Tavistock estate of the Duke of Bedford formerly belonged to the Abbey of Tavistock. It came into the possession of the Bedford family by Royal Grant at the dissolution of the monasteries. The property for the most part lies in and between the charming valleys of the rivers Tavy and Tamar, which, at the south end of it, are not more than one mile apart.

In configuration the country is much cut up into hills and valleys, the elevations in some parts being considerable. At Morwelldown, the south end is about 600 feet, and at Heathfield and Brentor on the north 800 to 1,000 feet above sea level. The geological formation is Devonian clay slate intersected by Elvan Dykes—a hard trap rock—and mineral veins. On the western side of Tavistock Parish some rich copper and arsenic mines have been worked, notably Devon Great Consols, the surface workings of which the members had an opportunity of inspecting. In a considerable portion of the northern part of the estate the overlying rock is a more or less hard volcanic ash, locally known as freestone, owing its origin to Brentor Tor, which is the remains of the cone of an extinct volcano. Wherever this rock occurs the soil is rich, and grazing land of a high quality is found. The woods for the greater part occupy the steep declivities of the valleys of the Tamar and Tavy, and land which was formerly part of two Commons. Morwelldown on the south of the estate and Heathfield on the north, were enclosed about the years 1820 and 1840, respectively. In the valleys some fine oak has been grown, but it has been liable to shakes. It has been noticed that the sessile oak is not so liable to this defect as the pedunculate.

The extent of the woods is a little over 3,000 acres, and may be approximately classed as follows;—

Oak coppice	-	-	850	acres
Plantations made since 1892	-	-	640	„
Old plantations and timber woods	-	-	1566	„
Mine wastes and heathlands	-	-	212	„

The present system of forest management commenced about

fifteen years ago. Previous to that date timber was cut down when it was absolutely unnecessary, and practically for many years no replanting was done. On the succession of the present Duke of Bedford, however, a more vigorous method chosen began, and now a certain quantity of marketable timber is felled each year and the land at once replanted. It may be imagined that at the commencement there were large areas on which timber had been felled, and had since lain idle, which had to be replanted. An area of oak coppice, sufficient to provide 60 to 80 tons of bark at about $2\frac{1}{2}$ tons per acre, is felled each year by the estate. This coppice, since the price of bark has been so low (£3 15s. this year) does not yield probably more than 1s.6d. to 2s.6d. per acre per annum for, say, 25 years' growth, and the remuneration is so small that for several years the area of coppice taken has been replanted with forest trees and the coppice stools killed as far as possible.

The woods are worked commercially, except around Endsleigh, where, although the commercial aspect is as far as possible kept in view, the main objects are picturesqueness and amenity. Rabbits, squirrels, and other vermin are stringently kept down and very little game is preserved on the estate. There is now being planted about 70 to 100 acres each year, and the nursery is large enough to cope with this and supply most of the plants.

In the course of their tour the members were furnished with several striking examples of the peculiarities of tree life. In one instance it was shown that through overgrowth a splendid beech died in two years. Then again, interesting information was imparted respecting Scots fir badly infested with the caterpillars of *Hylurqus*, *Piniperda* and *Retinia Buolana*. During the last week in May and the first in June, men were instructed to pinch them off and destroy them. The trees have now formed another good leader, and were looking well. Scots fir and Corsican pine were seen growing well on arsenical soil, while an opportunity was also afforded the members to examine how oak plants will grow mixed in a larch plantation.

Among the principal trees inspected in Endsleigh grounds were :—

Corsican	-	80 ft. high x 26 in. at 5 ft. high.
Douglas fir	-	100 ft. high x 26 in. at middle—469 cubic ft.
Douglas fir	-	80 ft. high x 40 in. at 5 feet high.
Weeping Beech		50 ft. high.
Larch	-	90 ft. x 24 in. at 5 feet high.
Scots Fir	-	90 ft. x 24 in. at 5 feet high.
Spanish Chestnut		90 ft. x 28 in. at 5 feet high.
Beech	-	90 ft. x 27 in. at 5 feet high.
Spanish Chestnut		60 ft. x 30 in. at 5 feet high.

There were several very high *C. Lawsoniana*, *Araucaria*, etc., with a magnificent specimen of *Cedrus Atlantica Glauca*.

The party were entertained at luncheon on the invitation of the Duke of Bedford, whose health was heartily drunk on the proposition of the President. Mr. ELWES commented on the circle of pure forestry they had had the opportunity of inspecting, and remarked he was sure they must all feel there was a great deal to be learnt there. (Applause). In addition to asking Mr. Rundle to express to the Duke their sincere thanks for the kind hospitality accorded them, he (the President) also hoped to have the pleasure of writing him privately, informing him of how much they had enjoyed the visit. (Applause).

Mr. RUNDLE and Mr. FORBES suitably replied to the toast. Mr. Rundle said he was sure His Grace was much gratified to think the members of the Society were visiting Endsleigh, and was sorry he could not be present. (Applause).

The members were presented with pictorial post cards of Endsleigh Cottage, and subsequently were photographed.

The party returned from Tavistock at 5-54 p.m., reaching Exeter about 8 o'clock.

This concluded the official programme of the meeting, but a number of the members availed themselves of the opportunity of visiting Powderham Castle at the invitation of the Earl of Devon on the Saturday.

THE ANNUAL MEETING.

The Annual General Meeting of the Society was held on Wednesday, August 15th, 1906, at 8-30 p.m., at the New London Hotel, Exeter, the retiring President (Professor Fisher) presiding.

MINUTES.

Mr. JOHN GRAHAM, Findon Cottage, near Durham, asked whether, inasmuch as the members of the Society had been furnished with copies, the minutes of the last Annual Meeting could not be taken as read.

This was readily agreed to.

MEMBERSHIP.

The ASSISTANT SECRETARY (Mr. Edward Davidson) reported on the membership as follows:—

Total number of members at beginning of year	-	756
During the year there had been—		
Resignations and lapses	- - -	31
Deaths	- - - - -	10— 41
		—
		715
Elected at Council Meetings	- - -	49
Elected at this Meeting	- - -	46— 95
		—
Total	- - -	810

Mr. A. GILLIES, Gateshead, proposed, and Mr. Mc.GIBBON, Wentworth, Rotherham, seconded the election of the new members proposed, which was carried unanimously.

CAPITAL ACCOUNT.

Gross liability to Life Members	-	£328	11	0
Amount payable to Revenue Account—				
71 Life Members at 7/-	£24	17	0	
4 " " 4/-	0	16	0	
			25	13 0
				<u>£302 18 0</u>
By Deposit in Bank	-	-	-	£124 8 0
By Cash in hand	-	-	-	109 16 1
				<u>234 4 1</u>
Net liability to Life Members	-	-	-	68 13 11
				<u>£302 18 0</u>

Mr. EDWARD DAVIDSON explained that there were one or two items heavier than usual. The Council Meeting expenses were £7 or £8 more; the cost of the *Transactions* had increased on account of there being more pages and illustrations and a larger number of copies required. The stationery and sundry printing account was also larger, due to the fact that, in consequence of their new title "Royal," they had new stationery to get, new rules circulated, and the reports of the Railway Rates Committee printed.

The report was adopted.

ELECTION OF PRESIDENT.

Professor FISHER then said he was about to propose a new President to succeed himself. He assured the members it had afforded him great pleasure to preside over the Society for the last two years, and he thought they had had some very pleasant tours together. (Applause). A great many of them were with him in Belgium, where, certainly, they had much harder work than in Devonshire. They were now in a most beautiful neighbourhood, and they had seen some very fine trees. (Applause). With regard to the Arboricultural Society, it was one which, in the last five or six years, had been rising in importance, and which, having started in the North, had now spread well over England, and probably into Wales. (Applause).

Further, he believed they even had Scotch and Irish members as well. (Applause). Therefore, as the Society was a great and rising one, and as silviculture was becoming very important in the country, it was necessary they should have an energetic President, one who would attend the meetings, was keen about forestry, and would use the Society as a force in pressing the claims of silviculture on landowners, the Government in general, and everybody who could help to enlarge the scope of silviculture in the country (Applause). He did not think they could have a better President than Mr. Elwes of Colesborne, Cheltenham, and he moved that he be appointed. (Applause). Mr. Elwes was a man who had travelled in many countries. So keen was he about the question that he was not satisfied in seeing trees as they grew at home, but as they grew on the Rocky Mountains, in Japan, India, Australia, and Siberia. In fact, wherever trees grew he went and inspected them. (Applause). Further, Mr. Elwes was bringing out an ornamental work on British Forest Trees. (Applause). He (Professor Fisher) did not think they could find a man who would further the claims of the Society more than Mr. Elwes. (Applause).

Mr. JOHN GRAHAM said he had the greatest possible pleasure in seconding the proposition. (Applause). With regard to Professor Fisher he never had occasion to find fault with him during the two years he was President until now. That fault was that he had taken the ground from under his (Mr. Graham's) feet, and told them everything that was requisite to know respecting Mr. Elwes. (Laughter). That would save them from a long speech. Some members might think Mr. Elwes was rather a young member to be placed in the position of President? But he maintained that it was quite possible for a gentleman who had been a member of the Society six years to show as much energy and be as active in the interest of the Society as if he had belonged to the Society from its inception. (Hear, hear). Mr. Elwes had been no stranger. (Hear, hear). He had attended every meeting possible for him to attend, and he would make an excellent successor to their admirable President, Professor Fisher. (Applause). Further, if the members of the Society went

abroad they would not find a better linguist to pioneer them through a foreign country. (Applause).

CAPTAIN DAVIDSON tendered compliments to Professor Fisher for the able manner in which he had presided over the Society for the last two years. (Applause). It had not been his (Capt. Davidson's) good fortune to have been with him as much as he would have desired, but on every hand he heard words of praise for the way in which he had filled the Presidential chair, with credit to himself and to the complete satisfaction of the members. (Applause). He also joined with Professor Fisher and Mr. John Graham, a past President, in supporting the name of Mr. Elwes. At the same time, however, he must say that the members from the North, from whence the Society emanated, had some slight hope that length of service was some recommendation at times even for the President's chair. He mentioned the name of Mr. Bernard Cowan. (Applause). Mr. Cowan had been connected with the Society from the first, and he believed the majority of the members would agree with him that he had done much able work in its interest. (Applause). If the Council could see their way in the future to place some mark of recommendation on long service, he believed it would be satisfactory to the whole of the members. (Applause). They were in no way opposed to the decision of the Council, but wished to express to them the hope that the service of old servants and men, who had been with them in the straits of youth and poverty would not be forgotten when they were more wealthy and progressive. They would rather see some recognition given to men who had given long service, while they lived, than any recognition given when they ceased to live. (Hear, hear).

MR. COWAN said he felt extremely grateful to Capt. Davidson for his remarks, and also for the manner in which they had been received. As regarded the candidature of Mr. Elwes, he wished to say that he was entirely in sympathy with the appointment, and he wished him health and happiness during his year of Presidency. (Applause). If there were any strong points in favour of his candidature, it was the energy and perseverance he showed in matters appertaining to the welfare of the Society. (Applause).

The proposition having been carried unanimously, Mr. Elwes entered the room, and took the chair now vacated by Professor Fisher.

The PRESIDENT, well received, said he wished to heartily thank the members for the honour done him. As he had not been connected with the Society many years, personally, he did not think his seniority was sufficient. There were members whom he would much rather have seen occupy the Presidential chair. For one, there was Sir Hugh Beevor, and he (the President) would have refused to accept the offer had he not told him that he would be unable to accept the office in consequence of the illness of his wife. Then again, there was Mr. Havelock. There was no forester who had shown greater ability than he had, or would excel as a chairman better than he would. But he, too, was unable to take the office. He (Mr. Elwes), thought that, in the future it would have to be considered whether it would not be wise to have a nominated Vice-President, who, in the absence of the President, would be able to preside, and who would subsequently be accepted President by the whole of the members of the Society. There could then be no question as to whose right it was to the Presidency. He thought they must all realise to the full how indebted they were to the members of the North of England who founded the Society and carried it on on a comparatively small scale. The Society had, however, now become The Royal English Arboricultural Society, and he thought it ought to be their united endeavour to try to raise it to the position of a National Society. (Applause). There were thousands of pounds wasted on properties in England annually through ignorance of the principles of forestry. It was not through want of interest so much as lack of knowledge, and he contended that it should be the business of every member of the Society to introduce into the Society as many influential people as they could. (Hear, hear). They would only get their due interests from the Legislature by pressure. They must look to the foresters to impress on their employers the claims of forestry; the employers to rub it into the county Members of Parliament, and the latter to rub it into the Cabinet. The Chancellor of the Exchequer seemed to look

upon the subject as a sort of harmless fad. They could not, however, expect to advance as they would desire to do if the Society adhered to all the old rules and practices. They were, no doubt, excellent for a comparatively small society, but, as it grew, they became out of date. Therefore, if some of the old members were inclined to think that he desired to come in and turn the old Society upside down, he hoped they would dismiss the thought from their minds. (Applause).

Before proceeding to the next business, Principal J. SMITH HILL, B.A., Aspatria, asked to be allowed to propose that a hearty vote of thanks be recorded on the minutes to Professor Fisher for his splendid services as President. Mr. CHARLES HANKINS, Bury St. Edmunds, seconded, and the proposition was cordially carried.

Professor FISHER, in reply, assured the members it had been a source of gratification to him to advance in any way silviculture in the country. (Applause).

ELECTION OF VICE-PRESIDENTS.

Messrs. C. G. GREY, M.A., Dublin, and A. T. GILLANDERS, Alnwick, were re-elected Vice-Presidents.

MEMBERS OF COUNCIL.

Sir Hugh Beevor, Bart.; Messrs. G. Cooper, Gateshead; A. C. Forbes, Dublin; and J. P. Robertson, Chatsworth; were re-appointed members of the Council.

Mr. Charles Miles, of Stamford, was nominated to succeed the new President as a Member of the Council, but declined to serve. Mr. R. McGibbon, of Wentworth, Rotherham, was appointed, and, in returning thanks, assured the members he would do his best for the Society. (Applause).

SECRETARY AND TREASURER.

Mr. John Davidson, and Mr. Edward Davidson were, by acclamation, appointed Secretary and Treasurer and Assistant Secretary respectively.

The PRESIDENT said he was sure it was quite unnecessary for him to mention any name as Secretary and Treasurer so long as Mr. Davidson was willing to take office. (Applause). The Society was growing year by year. Therefore, as the work was being considerably increased, he thought it would have to be considered whether it was possible for Mr. Davidson and his son to do the work for the sum allowed. They must not work a willing horse too much. Further, he thought the Council would support him in asking Messrs. Davidson senior and junior to act much more on their own responsibility than they did now in dealing with various little matters which crop up, instead of waiting for advice from the Council. It would save unnecessary delay and trouble, and if they did, as he said, he felt sure no one would find fault with them. (Hear, hear).

Mr. JOHN DAVIDSON, in thanking the members for the honour conferred on his son and himself, referred to the progress which the Society had made since its inception, and looked forward with hope to seeing great strides made as far as assistance from the Chancellor of the Exchequer or some other source was concerned, to encourage afforestation on waste land and forestry in general. He assured the members that, although at the present time he was a kind of sinecure as far as the actual working of the Society was concerned, any word which he, as about one of the oldest servants in the Admiralty could put in to advance the claims of forestry on the Legislature, he would be pleased to do. (Applause).

AUDITORS AND LOCAL SECRETARIES.

Mr. Bernard Cowan and Mr. Alderman Clough were elected Auditors.

The Local Secretaries were re-appointed, with the addition of Mr. Woodcock, of Hazelmere.

JUDGES OF ESSAYS.

Messrs. Jos. S. Gray, Richhill, Co. Armagh, and A. C. Forbes, Dublin, were re-elected Judges of Essays. Mr. John Maughan,

Jervaulx, did not seek re-election, and Professor Fisher was unanimously chosen to fill the vacancy.

FORESTRY EXAMINERS.

Messrs. Wm. Forbes, Langhall, Cheshire, W. B. Havelock, Brocklesby, and Principal J. SMITH HILL, B.A., Aspatria, were re-elected Forestry Examiners.

PRIZE ESSAYS.

Mr. Jos. S. Gray, submitted the report of the Judges on the Competitive Essays, and the following awards were made:—

Gold Medal.

“Life History of the Beech,” by Professor Boulger.

Bronze Medal.

Ditto.

by Mr. D. K. McBeath.

Mr. GRAY moved the acceptance of the Judges' decisions, Major BEADON seconded, and the proposition was carried.

ALTERATION OF RULES AND BYELAWS.

Professor FISHER proposed certain alterations in the Society's Rules and Bye-laws.*

Professor FISHER said there was no subject to which the Council had given greater attention. A sub-committee was appointed. The members went thoroughly into the matter, and, subsequently, their recommendations were dealt with by the Council. In heartily supporting the proposal to publish a Journal quarterly, in place of the annual publication, he maintained that in the interest of the cause which they had at heart, it was essential they should have it. A finely illustrated Journal was published quarterly in France, and, certainly if it could be done in France, it could be done by them. (Hear, hear). In fact, it would be a disgrace to the Society if it could not. Of course, the publication would mean an increased expenditure, but there was no doubt it would be worked as economically as possible. Further, as far as he could understand, they would receive support in the publication from Wales

* Copies of the Revised Rules have been forwarded to each member.

and Ireland. Then, probably, there were a number of their good friends in Scotland who would buy it; also Americans and a number of other people. As regards the question of increased subscriptions, they did not wish to put a tax on old members. They had been in the Society for years, had seen it through its rough days, and it was not wished to increase their responsibility. It was only hoped that those who could afford to do so would increase their subscription.

Captain DAVIDSON, in seconding the adoption of the Rules and Byelaws as amended, said he thought the alterations suggested would be for the good of the members, and ultimately for the good of the Society. (Hear, hear). He was pleased to hear of the proposal to publish a Journal quarterly, and as regards the increased subscription, he felt sure that in leaving the old members the option to add to their subscription, the Council had acted wisely. Personally, he would feel that, in securing the quarterly publication, he would be getting good value for whatever increased subscription he gave. (Hear, hear).

With reference to the expense to members of the Council attending meetings other than the Summer Meeting, Mr. COWAN expressed the opinion that travelling expenses should be allowed those who wished to apply for it. He moved an amendment to this effect.

Mr. GEORGE ROSS, Hexham, in supporting the adoption of the Rules, etc., as amended, disagreed with Mr. Cowan's amendment. He had had the opportunity of discussing the question with many members of the Council, and he believed they were unanimously satisfied with the arrangement existing at present, viz., that they can have their railway fare on application. He hoped they would go no further than that.

Mr. C. H. DONNE, Bury St. Edmunds, proposed, and Mr. H. A. PRITCHARD, St. Fagans, Cardiff seconded as a further amendment, that the railway expenses of all members of the Council attending meetings, other than the Summer Meeting, should be paid.

Only three members favoured Mr. Cowan's amendment, and seven Mr. Donne's, both of which were defeated. The alterations of the Rules and Byelaws as proposed were then carried unanimously.

JOURNAL OF FORESTRY.

The PRESIDENT, reporting on the consideration given to the publication of a Quarterly Journal, said it was considered an Editor should be appointed at a fixed salary, and it was suggested that Mr. A. C. Forbes, who had on almost every occasion he had competed in the examinations won a gold medal, should be asked to act as Editor, at a salary of £50 per year. Mr. Forbes, however, had been appointed an Expert and Adviser under the Irish Agricultural Department. Consequently, he did not feel able to accept the office, although he was prepared to do all he could to make the duties of the new Editor lighter. (Applause). The Council considered the matter, and the difficulty was solved by the late President (Professor Fisher) generously offering to undertake the duties in conjunction with Mr. Forbes, gratuitously. (Applause). The matter had been looked upon by some members as one likely to rush the Society into a responsibility it could not afford, but he (the President) was convinced of the overwhelming importance of having a Journal worthy of the Society—(applause)—and he had no doubt the expense which would be incurred, additional to the expense already incurred, and which amounted to £91, could be more than recouped by the additional subscriptions and copies sold outside. (Hear, hear). Mr. Forbes had had a consultation with the firm of printers who printed the *Transactions* at present, and he had informed him it would probably be possible to publish a Quarterly Journal with suitable illustrations, at a cost not to exceed, and possibly not amount to £50 a quarter. So that the whole of the additional expense they would be called upon to incur would, at the outside, be something like £100, and until he found the Society could do this, he (the President) would make it his business to find guarantors, so that no risk should occur. Several gentlemen had already intimated their willingness to become guarantors. If it was decided to publish the Journal he hoped the members would do their very best to send to the Editor or Publishing Committee (to be appointed by the

Council) any really interesting notes of a practical character which they might gather in their local experience, and that they would put their own Journal first before sending matter to other public Journals.

It was decided that the Council be authorised to take steps to publish a Quarterly Journal, the title to be fixed later.

SUBJECTS FOR ESSAYS.

On the proposition of Mr. GRAY, the consideration of the subjects and prizes for essays for the ensuing year, and the place for the next Summer Meeting was left to the Council.

1907 SUMMER MEETING.

Ireland and Gloucester were suggested as places for visiting, and the suggestions were sent to the Council.

VOTES OF THANKS.

Principal SMITH HILL proposed a vote of thanks to Mr. S. Margerison for the assistance he gave to the Society in Belgium by taking photographs during the tour. He took some sixty photographs, some thirty-three of which were accepted by the Publishing Committee. The proposition was heartily carried, as also was one by Professor FISHER, thanking Mr. HILL for furnishing the Society with the Report of the Proceedings.

Statement of Accounts for

RECEIPTS.		REVENUE
By balance brought forward—		
In Bank	- - - -	£124 8 0
„ Hand	- - - -	82 0 9
		<hr/>
„ Subscriptions—Life Members	-	£206 8 9
Ordinary	-	39 18 0
		<hr/>
„ Advertisements	- - - -	£282 10 0
„ Donation from Mr. W. B. Havelock, to-		12 15 0
wards illustrating “Transactions”	-	5 0 0
„ Interest-	- - - -	2 16 3
		<hr/>
		£509 10 0

CAPITAL	
Gross liability to Life Members	- £328 11 0
Amount payable to Revenue Account—	
71 Life Members at 7/-	£24 17 0
4 „ „ 4/-	0 16 0
	<hr/>
	25 13 0
	<hr/>
	<u>£302 18 0</u>

the year ended August, 1906.**ACCOUNT.****PAYMENTS.**

Railway fares to Council Meetings
and use of rooms for same—

London, October, 1905	-	-	£23	11	6
York, March, 1906	-	-	12	1	0
			<hr/>		
			£35	12	6
Medals	-	-	-	17	17 0
Printing "Transactions" and Illustrations	-	-	-	91	11 6
Stationery	-	-	-	13	3 9
Sundry Printing	-	-	-	30	16 6
Postages, Telegrams, &c.	-	-	-	27	18 0
Reporter's Fee	-	-	-	3	3 0
Removing Plants presented by Hon. Mark Rolle to Tubney	-	-	-	6	10 0
Expenses of Deputation to the Chancellor of the Exchequer	-	-	-	5	12 7
Expenses of various Committee Meetings	-	-	-	2	11 1
Salary of Secretary and Treasurer	-	-	-	25	0 0
„ Assistant Secretary	-	-	-	15	10 0
			<hr/>		
			£275	5	11
By Deposit in Bank	-	-	124	8	0
„ Cash in Hand	-	-	109	16	1
			<hr/>		
			234	4	1
			<hr/>		
			£509	10	0

ACCOUNT.

By Deposit in Bank	-	-	-	-	£124	8	0
„ Cash in Hand	-	-	-	-	109	16	1
					<hr/>		
					234	4	1
Net liability to Life Members	-	-	-	-	68	13	11
					<hr/>		
					£302	18	0

Examined and found correct,

BERNARD COWAN, }
WILLIAM CLOUGH, } *Auditors.*

APPENDIX.

THE

Royal English Arboricultural Society

LIST OF OFFICE-BEARERS AND MEMBERS

CORRECTED TO OCTOBER, 1906.

Patron.

His Most Gracious Majesty the King.

Past Presidents.

The Right Hon. the Earl of Durham, Lambton Castle, Durham
 The Right Hon. the Earl of Carlisle, Naworth Castle, Brampton
 The Right Hon. Lord Avebury, High Elms, Hayes, Kent
 Thomas Taylor, Esq., Chipchase Castle, North Tyne
 The Right Hon. the Earl of Crewe, Crewe Hall, Crewe, Cheshire
 The Right Hon. Lord Masham, Swinton, Masham
 John Maughan, Esq., P.A.S.I., Jervaulx, Middleham
 F. W. Beadon, Esq., Longley Hall, Huddersfield
 Mr. Coroner Graham, Findon Cottage, Sacriston, Durham
 Professor Somerville, Banbury Road, Oxford
 George Marshall, Esq., Godalming, Surrey
 Professor W. R. Fisher, 6 Linton Road, Oxford

President

H. J. Elwes, Esq., F.R.S., Colesborne, Cheltenham

Vice-Presidents.

John Scott, Newton, Stocksfield
 William Milne, Hexham
 J. W. Robson, Hexham
 William Forbes, Estate Office, Shotwick Park, Langhall, Cheshire
 W. D. Cruddas, Haughton Castle, Northumberland
 Bernard Cowan, F.R.H.S., South Shields
 Joseph S. Gray, Richhill, Co. Armagh
 George Gallie, Sledmere, York
 W. B. Havelock, The Nurseries, Brocklesby
 Principal J. Smith Hill, The Agricultural College, Aspatria
 C. G. Grey, Dublin
 A. T. Gillanders, Alnwick Castle, Alnwick

Honorary Vice-Presidents.

M. Daubré, Directeur des Eaux et Forêts, Paris
M. Dubois, Directeur Général des Eaux et Forêts, Brussels

Members of Council.

A. J. Forrest, Thorney, Peterborough
Edward Shipley, 20 North Road, Darlington
W. A. Herd, Nurseryman, Penrith
Wm. Elder, Ollerton, Notts.
Chas. Hankins, Wordwell, Culford, Bury St. Edmunds
George Ross, The Nurseries, Hexham
T. Bewick, Raby Castle, Staindrop, Darlington
Leslie S. Wood, High Street, East Grinstead
Professor Potter, Armstrong College, Newcastle
D. Hamilton, Knowsley, Prescot
T. W. Luke, Greenshaw Plain, Hexham
W. A. Forster, Belgrave Lodge, Pulford, Wrexham
Thomas Roberts, Easebourne, Midhurst
Professor Fraser Storey, Bangor, North Wales
Robert Anderson, Cirencester
James Barrie, Stevenstone, Torrington
George Cooper, Gateshead
A. C. Forbes, Dept. of Agriculture, Dublin
J. P. Robertson, Chatsworth, Derbyshire
Sir Hugh Beevor, Bart., Croxley Green
R. Mc.Gibbon, Wentworth, Rotherham
Capt. Davidson, Presville, Kent Road, Harrogate
N. Temperley, J.P., Low Fell, Gateshead

Secretary and Treasurer.

John Davidson, Estate Office, Haydon Bridge, Northumberland

Assistant Secretary.

Edward Davidson, Estate Office, Haydon Bridge, Northumberland

Auditors.

Bernard Cowan, Westoe, South Shields
Alderman Clough, Gateshead

Local Secretaries.

W. B. Havelock, Brocklesby, Lincolnshire
William Forbes, Estate Office, Shotwick Park, Langhall, Cheshire
Bernard Cowan, Westoe, South Shields
William Fleming, Tudhoe, Durham
James Barrie, Torrington, North Devon
Francis Mitchell, Woburn, Bedford
Edward Shipley, 20 North Road, Darlington
Frank Hull, Lillieshall, Newport
W. A. Forster, Belgrave Lodge, Pulford
W. Tomlinson, Clumber, Worksop
A. J. Forrest, Thorney
William Elder, Ollerton, Notts.

Thomas Roberts, Midhurst, Surrey
 Edward Davidson, Estate Office, Haydon Bridge
 Robert Coupar, Ashford, Co. Galway
 W. Storie, Higholere, Newbury
 John Mitchell, Strid Cottage, Bolton Abbey
 Charles Hankins, Bury St. Edmunds
 D. A. Glen
 A. T. Gillanders, Alnwick Castle, Alnwick
 Thomas Lewis, Fair Oak House, Roath Park, Cardiff
 Capt. Davidson, Harrogate
 D. C. Legard, Lincoln
 R. F. Woodcock, Haslemere

Judges.

Joseph S. Gray, Richhill, Co. Armagh
 A. C. Forbes, Dublin
 Professor W. R. Fisher, Oxford

Forestry Examiners.

William Forbes, Estate Office, Shotwick Park, Langhall, Cheshire
 W. B. Havelock, Brocklesby
 Principal J. Smith Hill, B.A., Aspatria

Honorary Members.

Date of Election	
1883	Avebury, The Right Hon. Lord, High Elms, Hayes, Kent
1882	Balden, John, Bywell, Stocksfield
1905	Bommer, Monsieur C., Jardin Botanique, Brussels
1893	Bougler, Professor, F.L.S., F.G.S., 11 Onslow Road, Richmond, S.W.
1887	Carlisle, The Right Hon. the Earl of, Naworth Castle, Brampton, Cumberland
1883	Clark, Henry, H. Clark & Sons, The Saw Mills, Haltwhistle
1900	Clibran, A., Hale Farm Nurseries, Altrincham
1900	Clibran, L., Hale Farm Nurseries, Altrincham
1905	Crahay, Monsieur N. J., Inspecteur Principal, Belgian Forest Service, Brussels
1902	Daubré, Monsieur, Conseiller d'Etat et Directeur des Eaux et Forêts, 78 Rue de Varenne, Paris
1905	Dubois, Monsieur, Directeur Général des Eaux et Forêts, Ministère de l'Agriculture, Brussels
1885	Durham, The Right Hon. the Earl of, Lambton Castle, Durham
1905	Eastwood, Miss Alice, Secretary of the California Academy of Science, San Francisco, U.S.A.
1883	Fernow, B. E., New York State College of Forestry, Cornell University, Ithaca, N.Y.
1900	Fletcher, Dr., Entomologist and Botanist, Central Experimental Farm, Ottawa, Canada
1901	Herd, S., 24 Wordsworth Street, Penrith
1902	Lafosse, Monsieur, Conservateur des Eaux et Forêts, Dep. de l'Agriculture, 78 Rue de Varenne, Paris
1905	Mayr, Professor, Director of the Royal Bavarian Forest Institute, Munich, Germany
1890	Mitchell (Mrs.), Strid Cottage, Bolton Abbey, Skipton

Date of
Election

- 1905 Miyabe, Professor Kingo, Professor of Botany at the Imperial Agricultural College, Sapporo, Japan
1894 Nicholson, George
1905 Pardé, M. Leon, Inspecteur des Eaux et Forêts, Beauvois, France
1902 Peiffer, Monsieur, Inspecteur des Eaux et Forêts, Compiègne, France
1905 Pinchot, Gifford, U.S. Dept. of Agriculture, Washington, U.S.A.
1902 Récoq, Monsieur, Administrateur des Eaux et Forêts, 78 Rue de Varenne, Paris
1905 Sargent, Charles Sprague, Harvard University, U.S.A.
1905 Shirasawa, Dr. M. Homi, of the Imperial Bureau of Forestry, Tokio, Japan
1892 Somerville, Professor, 121 Banbury Road, Oxford

Life Members.

- 1905 Adkin, B. W., Land Agent and Surveyor, 14 Queen Street, Cheapside, E.C.
1882 Admiralty, Lords Commissioners of, Greenwich Hospital Branch, Whitehall, S.W.
1900 Aris, J. Whitton, M.A., F.S.I., Lois Weedon House, Towcester, Northamptonshire
1895 Armstrong, Lord, Cragside, Rothbury
1895 Balfour, Professor Isaac Bayley, The University, Edinburgh
1882 Barrie, James, Forester, Stevenstone, Torrington, N. Devon
1902 Barrie, James Alexander, Forester, Harlestone, Northampton
1895 Barron, John, Elvaston Nurseries, Derby
1896 Beaumont, W. C. B., M.P., Bywell Hall, Stocksfield
1902 Bedford, His Grace the Duke of, K.G., Woburn Abbey, Bedfordshire
1895 Bolam, George, Land Agent, Berwick-upon-Tweed
1895 Boord, W. B., Beverley, Pateley Bridge, Yorks.
1890 Bouverie, Henry H. P., 1 Pall Mall East, London, S.W.
1890 Burrill, T. O., Masham, Bedale, Yorkshire
1906 Campbell, Hon. Ian M., Stackpole Court, Pembroke
1901 Carr, Cuthbert E., Land Agent, 1 Collingwood Street, Newcastle
1904 Champion, G. E., Estate Office, Linton Park, Maidstone
1901 Clibran, Wm. R., Nurseryman, Oldfield Nursery, Altrincham, Cheshire
1906 Coke, The Hon. Richard, Holkham Hall, Norfolk
1905 Crisp, Fred A., "Broadhurst," Godalming, Surrey
1896 Dalgleish, J. Edward, The Nurseries, Market Weighton
1905 Dimsdale, Robt., Ravenshill, Lechlade, Glos.
1897 Dorman, A. J., Grey Towers, Nanthorpe, R.S.O., Yorks.
1900 Elliott, B. G., Timber Merchant, 124a Kentish Town Road, London, N.W.
1902 Eve, Harry T., K.C., Pullabrook, Bovey Tracey, South Devon
1900 Fairfax-Cholmeley, Hugh C., Brandsby, Easingwold
1902 Foster, John, jun., Horton-in-Ribblesdale, Settle, Yorks.
1902 Fox, Wm. F., Adbury, Newbury
1902 Gilchrist, Professor, Armstrong College, Newcastle-on-Tyne
1893 Gough, W., Wykeham, York
1888 Graham, John, Findon Cottage, Sacriston, Durham
1905 Gurney, Eustace, Sprowston Hall, Norwich
1883 Havelock, W. B., The Nurseries, Brooklesby, Lincolnshire
1895 Headlam, Colonel J., R.A., Hanwood, near Shrewsbury
1899 Hill, Principal J. Smith, B.A., Agricultural College, Aspatria
1902 Hinckes, Ralph T., Foxley, Hereford
1902 Hooker, Reginald H., 3 Clement's Inn, W.C.

Date of
Election

- 1895 Huggon, Thos., Estate Bailiff
 1887 Joicey, Edward, Blenkinsopp Hall, Haltwhistle
 1887 Jonas, Henry, Surveyor, 23 Pall Mall, London, S.W.
 1904 Jonas, H. Driver, 23 Pall Mall, London
 1905 Jones, Walter, Land Agent, Lechlade Manor, Gloucestershire
 1897 Lamb, Major S. E.
 1897 Lamb, R. O., Hayton Hall, How Mill, near Carlisle
 1900 Leeds, His Grace the Duke of, Hornby Castle, Bedale
 1890 Leyland, C. J., Haggerston Castle, Beal, Northumberland
 1897 Lockey, W.
 1905 Mahler, John, Penissa Glyn, Chirk, N. Wales
 1896 Marchant, R. C., M.R.A.C., F.C.S., P.A.S.I., 18 Elliston Road, Redland, Bristol
 1895 Margerison, Samuel, Calverley, Leeds
 1889 Marshall, S. A., Skelwith Fold, Ambleside
 1883 Marshall, R. D., Castle Rigg Manor, Keswick
 1901 Martin, James, Wood Manager, Knipton, Grantham
 1895 Maaham, The Right Hon. Lord, Swinton, Maaham
 1891 Maughan, John, P.A.S.I., Land Agent, Jervaulx, Middleham
 1906 Michie, Wm., Forester, Woodhouse Hall, Welbeck, Worksop
 1899 Middleton, Sir Arthur E., Bart., Helsay Castle, Newcastle-on-Tyne
 1902 Middleton, Professor, Agricultural Department, Cambridge University
 1886 Newbiggen, John T., Kennedy & Co., Nurserymen, Dumfries
 1902 Northumberland, His Grace the Duke of, K.G., Alnwick Castle, Alnwick
 1903 Parker, Thomas, Estate Office, Highclere, Newbury, Berks.
 1906 Parker, Hon. Henry, Shirburn Castle, Wallingford, Berks.
 1906 Pattison, W. H. M., P.A.S.I., Land Agent, Estate Office, Helmingham, Suffolk
 1893 Peel, Edward L., 9 Whitehall Place, London, S.W.
 1883 Plummer, Arthur B., Architect, Prior's Terrace, Tynemouth
 1895 Portland, His Grace the Duke of, Welbeck, Worksop
 1905 Rogers, Chas. Gilbert, Imperial Forest Service of India, c/o Messrs. Grindlay & Co., 54 Parliament Street, S.W.
 1892 Rolle, The Hon. Mark, Stevenstone, Torrington
 1883 Sample, C. H., Land Agent, Matfen, Corbridge
 1905 Skelley, Sir John C. E., Bart., Avington, Alresford, Hants.
 1901 Smyth, Hugh Lyle, J.P., D.L., Barrowmore, Chester
 1901 Stirling, C., Gargunnoch, Stirlingshire
 1904 Story, Professor Fraser, Lecturer on Forestry, University College of North Wales, Bangor, Wales
 1895 Straker, J. H., Howden Dene, Corbridge
 1890 Straker, J. C., The Leazes, Hexham
 1904 Sutherland, His Grace the Duke of, K.G., Lillieshall House, Newport, Shropshire
 1903 Taylor, W. F., Nurseryman and Seed Merchant, Lytton Nurseries, Stevenage, Herts.
 1906 Trollope, Thos. C., Crowcombe Court, Taunton
 1893 Veitch, Harry James, 34 Redcliffe Gardens, South Kensington, London, S.W.
 1901 Waring, William A., Woodlands, Chelsfield, Kent
 1896 Watney, Daniel, 33 Poultry, London
 1883 Watt, James, Little & Ballantyne, Carlisle
 1905 Wellington, His Grace the Duke of, Ewhurst Park, Basingstoke
 1894 Wood, A. F. N., Belawardyne Hall, Shrewsbury
 1903 Woodruffe-Peacock, Rev. E. Adrian, Cadney Vicarage, Brigg
 1906 Young, F., Head Forester, Paulton Park, near Totten, Hants.

Ordinary Members.

Date of Election	
1905	Ackers, B., St John, Huntley Manor, Gloucester
1905	Ackers, C. P., Huntley Manor, Gloucester
1902	Ackroyd, George H., Head Gardener, Howick, Leebury
1904	Adams, S. J., Forester and Clerk of Works, Adscombe Cottage, Over Stowey, Bridgwater
1904	Adams, J. W. Atken, Resident Agent, Estate Office, Moat Mount, Mill Hill, Middlesex
1902	Affleck, R., J.P., Bloomfield, Durham Road, Gateshead
1904	Aitken, G. H., Land Agent, Longleat Estate Office, Warminster
1886	Alexander, William, South View, Hexham
1896	Allan, Alexander, Forester, 41 Bradford Street, Caerphilly, Cardiff
1906	Allen, Jesse, Timber Merchant, The Terrace, Salter Gate, Chesterfield
1906	Allsebrook, A., B.Sc. (Edinburgh), F.S.I., Estate Office, Madresfield, Malvern
1906	Allsop, A. J., Parks Superintendent's Office, Municipal Buildings, Leeds
1906	Almond, Ernest A., Assistant Forester, Oxshott, near Leatherhead, Surrey
1891	Ames, Victor, Forester, Thornham Cottage, King's Lynn, Norfolk
1902	Anderson, Robert, Assistant Forester, Hursley Park, Slackstead, Romsey
1903	Anderson, Robert, Land Agent, Cirencester
1906	Anderson, George, Forester, Sherborne Castle, Sherborne, Dorset
1901	Andrew, Duncan, 8 Rainton Terrace, Park Road, Hale, Cheshire
1905	Annet, Thos., Assistant Forester, c/o Mr. A. Payne, Bower Ashton, near Bristol
1906	Archibald, John C., Head Forester, Eden Hall, Langwathby, R.S.O., Cumb.
1905	Argent, Thos., Forester, Buscot Park, Faringdon, Berks
1892	Armitage, Fred., 3 Burston Road, Putney, London, S.W.
1882	Armstrong, T. J., Land Agent, 14 Hawthorn Terrace, Newcastle
1898	Armstrong, W., Land Agent, Sunderlandwick, Driffild, Yorks.
1893	Armstrong, Addison & Co., Timber Merchants, Sunderland
1898	Armstrong, Thomas, Timber Merchant, Cockermouth
1904	Arnott, James, 9 Elington Terrace, Newcastle-on-Tyne
1906	Arthur, L., Assistant Forester, Ampfield, Romsey
1905	Ashdown, A. H., Land Agent, Uppington, Wellington, Salop
1900	Ashworth, G. W., Timber Merchant, Waterfoot
1902	Atkin, James T., Salisbury House, South Shields
1894	Atkinson, William, Royal Nurseries, Handsworth, Sheffield
1900	Atkinson, W. Peurose, Nurseryman, Handsworth, Sheffield
1902	Atkinson, Thomas H., St. Eilans, Hexham
1903	Bagshaw, C., c/o H. S. King & Co., 9 Pall Mall, London, S.W.
1900	Bailiffs, John, Forester, Poole, South Milford, Yorks.
1906	Baker, George Ed., Magdalen College, Oxford
1900	Bainbridge, T. R., Grove House, How Mill, near Carlisle
1882	Balden, Robert S., Bywell, Leeds Road, Dewsbury
1902	Ballantyne, John, Foreman Forester
1898	Balme, Frank M. P. Jones, J.P., High Close, Ambleside
1893	Barclay, David, Sherbourne, North Leach, Gloucestershire
1899	Barclay, Robert Leatham, 54 Lombard Street, London, E.C.
1901	Barfoot, William S., Assistant Forester, Flimwell, near Hawkhurst, Kent
1905	Barker, A., Forester, Shanbally, Clogheen, Cahir, Co. Tipperary, Ireland

Date of
Election

- 1895 Barnard, The Right Hon. Lord, Raby Castle, Staindrop, Darlington
 1906 Barnard, Christopher, Thorney, near Peterborough
 1905 Barnes, W., The Gardens, Bear Wood, Wokingham
 1882 Barrett, R. B., Skipton Castle, Skipton
 1890 Barrie, William, Ellerton, York
 1902 Barrie, David H., Forester, Llaugedrwyn Hall, Llaugedrwyn, near Oswestry, N. Wales
 1904 Barton, H. S., Land Agent, Hewshott House, Liphook, Hants
 1899 Batchelor, E. J., Nurseryman, Harlow Heath Nurseries, Harrogate
 1892 Bayliss, Jones & Bayliss, Victoria Works, Wolverhampton
 1906 Bazley, Gardner, Hatherop Castle, Fairford
 1882 Beadon, F. W., Land Agent, Estate Office, Huddersfield
 1882 Beattie, Thomas, Assistant Forester, Langley Old Hall, Huddersfield
 1905 Beaver, Robt., Assistant Forester, Crookise, via Skipton
 1901 Beeson, Walter, Estate Agent, St. John's College, Oxford
 1903 Beeton, H. R., 9 Maresfield Gardens, Hampstead, London
 1900 Beavor, Sir Hugh, Bart., 17 Wimpole Street, Cavendish Square, London, W.
 1895 Bell, J. R., Thorpe Perrow, Bedale
 1895 Bell, Thomas, Forester, Widdrington Cottage, Acklington
 1900 Bell, Charles L., Wolsington Hall, Newcastle-on-Tyne
 1905 Bennet, John, Forester, Towns End, Wolverton, Basinstoke, Hants
 1906 Bennett, Wm., Head Gardener, Marine Parks, South Shields
 1904 Benson, R. T., Auctioneer, Parkside House, Darlington
 1904 Bentley, Joseph, Chemical Manufacturer, Barrow-on-Humber, Hull
 1905 Berney, A. H., Land Agent, Estate Office, Damerham, Salisbury
 1900 Berry, George, Cockle Park, Morpeth
 1892 Bewick, Thomas, Head Forester, Raby Castle, Staindrop, Darlington
 1897 Bewick, John William, Forester, Streatham Castle, Darlington
 1899 Blair, Percy A. F., Lindon Grove, Nutton Rudly, Cleveland
 1906 Blundell, Edward, Professor, Royal Agricultural College, Cirencester
 1893 Boa, Andrew, Land Agent, Great Thurlow, Haverhill
 1905 Bodger, W. Thos., 10 Urfa Terrace, South Shields
 1901 Bolitho, T. R., Trengwainton, Hea Moor, R.S.O., Cornwall
 1905 Bolton, Miss Elsie H., Leeming-on-Ullswater, Penrith
 1900 Bond, Thomas, Head Forester, Lambton Castle, Durham
 1902 Boorman, Alfred S., Assistant Forester, Bedgebury Park, Goudhurst, Kent
 1904 Borthwick, Dr. A. W., D.Sc., Royal Botanic Gardens, Edinburgh
 1904 Boston, Richard, Hallgarth House, Carthorpe, Bedale
 1903 Bourne & Sons, Messrs., Nurserymen, Royal Nurseries, Beckington, near Bath
 1904 Bovill, Geo. B., Land Agent, Rhydycreua, Bettws-y-Coed, N. Wales
 1906 Bowdon, John F., F.S.I., Surveyor and Land Agent, Bedford Chambers, Exeter
 1900 Bowker, Joseph, Superintendent of Cemeteries, Darlington
 1901 Bowles, William A., Head Gardener, Adare Manor, Adare, Co. Limerick, Ireland
 1905 Bowman, John, Timber Merchant, Newcastle-on-Tyne
 1901 Bown, Arthur, Architect, James Street, Harrogate
 1902 Boyd, John, Forester, Wood Cottage, Kennishead, Thornliebank
 1904 Bradford, Dr. John Rose, F.R.S., 8 Manchester Square, London, W.
 1903 Braid, J. B., Forester, The Park, Great Whitly, Stourport, Worcestershire
 1906 Brice, A. W. Ruggles, Spain's Hall, Braintree, Essex
 1905 Briggs, Arthur C., Gledhow Grange, Leeds
 1897 Bright, Tom, Estate Agent and Valuer, 10 Mount Street, Grosvenor Square, London, W.

Date of Election	
1891	Broadbent, George Alexander, 33 Cleveland Road, Huddersfield
1903	Brocklehurst, H. D., Sudeley Castle, Winchcombe
1901	Brodie, Hugh R., Bedford Office, Thorney, near Peterborough
1898	Brown, William, Saw Mills, Brandon, Suffolk
1903	Brown, W. R., Head Forester, Park Cottage, Heckfield, Winchfield, Hants
1905	Brown, Edw. J., 16 Bigby Street, Brigg, Linca.
1906	Brown, Thomas W., Gardener, 59 Gloucester Road, Kew
1906	Brownlow, The Right Hon. Earl, 8 Carlton House Terrace, London
1898	Bruce, Nathan M., Forester, Old Hall, Snettisham, Norfolk
1905	Brunton, James, Assistant Forester, Chatsworth Estate, Pilsley, Bakewell, Derbyshire
1894	Brydon, John, Messrs. Kent & Brydon, Nurserymen, Darlington
1903	Buchanan, Henry, Land Agent, Ashford, near Bakewell
1906	Bulman, Henry J., Timber Merchant, 98 Dover Street, South Shields
1895	Burnett, G. J. M., Land Agent, Elstree Cottage, Elstree
1906	Burroughes, Chas. F., Land Agent, 37 Lincoln's Inn Fields, London
1900	Cadell, George, 20 Murrayfield Drive, Edinburgh
1899	Caldecott, John A., Long Lawford, Rugby
1902	Caldwell & Sons, Nurserymen, Knutsford, Cheshire
1894	Cameron, Alexander, Forester, Longleat, Warminster, Wilts
1900	Cameron, J. J., A. & J. Main & Co., Limited, Clydesdale Iron Works, Possil Park, Glasgow
1906	Capon, Frank, Surveyor, 9 Conduit Street, London, W.
1903	Capper, H. F., Estate Agent, The Northgate, Ross, Herefordshire
1903	Capper, Captain R. H. Ord, The Northgate, Ross, Herefordshire
1901	Carradus, W., Assistant Forester, Wray, Hornby, Lancaster
1895	Carriek, Thomas, Haydon Park, Haydon Bridge-on-Tyne
1894	Cartlidge, J. C., Rufford Mill, Ollerton, Newark
1902	Castle, R. Lewis, F.R.H.S.
1902	Caswell & Bowden, Ltd., Timber Merchants, Newton Chambers, Cannon Street, Birmingham
1906	Caveudish, Right Hon. Victor, M.P., Holker Hall, Lancashire
1906	Chamier, E. F., Rolle Estate Office, Exmouth
1901	Chapman, F., Forester, Wansford, Northants
1905	Chapman, H., Forester, Shanbally Castle, Clogheen, Co. Tipperary, Ireland
1906	Charlesworth, Joseph H., "Melbourne," Brampton Road, Bexleyheath, Kent
1906	Charlton, John M., Assistant Forester, Chatsworth, Pilsley, Bakewell, Derbyshire
1902	Cheesman, Robert E., Chatsworth, Chesterfield
1906	Clare, Edward Lovell, Land Agent, 11 Dale Street, Liverpool
1882	Clark, J. M., Land Agent, Haltwhistle
1891	Clark, Thomas, Wentworth Nurseries, Hexham
1902	Clark, E. T., The Goddards, Snaith, R.S.O., Yorkshire
1902	Clark, John, Head Forester, Swinton, Masham, Yorkshire
1905	Clarke, J. S., Estate Agent, Bothal, Morpeth
1891	Clarke, Christopher, Land Agent, Charlcot, Bedale
1892	Clarke, J. W., Land Agent, Guisborough, Yorks
1902	Clarke, Thomas, Eskmeals, Bootle, S.O., Cumberland
1902	Clarke, Joseph, Forester, Rose Cottage, Shipbourne, Tonbridge, Kent
1901	Clayton, John W., Forester, Manby Lodge, Broughton, Brigg
1901	Clayton, Thomas L., Assistant Forester, Manby Lodge, Broughton, Brigg, Linca.
1906	Clayton, Henry J., Gardener, Grimston Park, Tadcaster
1904	Cleeves, Charles M. R., Land Agent, Highfields, Frant, Sussex

Date of
Election

- 1906 Clifford, H. J., The Grange, Frampton-on-Severn, Stonehouse
 1906 Clifford, M. H., 59 Canynge Road, Clifton, Bristol
 1894 Clough, W., Ravenhurst, Low Fell, Gateshead
 1902 Clough, A. H., Castletop, Burley, Ringwood, Hants.
 1904 Cobb, Herbert, Land Agent, Higham, Kent
 1900 Coles, S. H. Cowper, Land Agent, Penmyarth, Crickhowell
 1890 Collins, F., Forester
 1900 Colton, John H. C., c/o G. & T. Coward, Carlisle
 1906 Conant, E. W. P., Lyndon Hall, Oakham
 1899 Conway, Thomas, Forester, High Legh, Knutsford, Cheshire
 1888 Cooper, George, Superintendent of Cemetery, Gateshead
 1899 Corking, Joseph T., 42 Jackson Street, Gateshead
 1895 Cosans, John, Abbey View, 56 Tragan Avenue, South Shields
 1886 Coupar, Robert, Forester, Ashford, Co. Galway
 1906 Counts, John, Head Gardener, Killerton, Broadclyst, via Exeter
 1904 Coventry, B. O., Indian Forest Service, Murrice, Punjab, India
 1882 Cowan, Bernard, F.R.H.S., The Lodge, Harton Cemetery, South Shields
 1906 Cowie, George H., 44 Park Road, Altrincham
 1902 Cox, W. W., Forester, Newby Lodge, Ripon
 1899 Cranston, George, Dryderdale, Hamsterley, via Witton-le-Wear, Darlington
 1906 Crawley, John Kenneth, Land Agent, Estate Office, Brandon Park, Suffolk
 1896 Crewe, The Right Hon. the Earl of, Crewe Hall, Crewe, Cheshire
 1901 Crombie, T. Alex., Head Forester, Estate Office, Longhurst, Morpeth
 1904 Crooks, James, Eccleston Park, Prescot
 1905 Crooks, F., "Woodlands," Eccleston Park, Prescot
 1903 Crosland, W., J.P., Estate Office, Buscot Park, Faringdon, Berks.
 1894 Crowell-Pollard, J., 53 Rutland Gardens, Hove, Brighton
 1902 Crozier, John, Forester, Durris Estate, Aberdeen
 1884 Cruddas, W. D., Haughton Castle, Humshaugh, R.S.O.
 1897 Cummings, W., Forester
 1904 Cundy, Joseph W., Land Agent, Linby, Notts.
 1904 Currie, Archibald, 48 Jesmond Road, Newcastle-on-Tyne
 1902 Dalton, Col. H. Wade, Hauxwell Hall, Constable Burton, Yorks
 1905 Dashwood, A. H., Stibbington House, Wansford
 1883 Davidson, William, Presville, Kent Road, Harrogate
 1882 Davidson, John, Land Agent, Haydon Bridge-on-Tyne
 1893 Davidson, Edward, Estate Office, Haydon Bridge-on-Tyne
 1894 Davidson, John, jun., Chesterwood, Haydon Bridge
 1901 Davidson, W., Head Forester, Manor Yard, Margam, Port Talbot
 1901 Davidson, Thomas E., Architect
 1906 Davidson, Matthew, Head Gardener, Post Office, Lee Lane, Horwich, near Bolton
 1906 Davies, Wm. H., Assistant Forester, Pilsley, Bakewell, Derbyshire
 1899 Deane, Arthur, Forester
 1895 Dent, John W., Wm. Wear & Co., Timber Merchants, Hexham
 1906 Devonshire, His Grace the Duke of, Chatsworth, Chesterfield
 1898 Dickinson, William, Forester, Park House, Arundel, Sussex
 1893 Dixon, W., Falkenberg, Harrogate
 1885 Dodsworth, F. & W., Collingwood Street, Newcastle-on-Tyne
 1894 Doig, C., Forester, Newball, Langworth, Lincoln
 1905 Donne, C. H., Land Agent, The Abbey Ruins, Bury St. Edmunds
 1900 Drane, Donald, Land Agent, Roughton, Norwich
 1906 Drew, Henry A., F.S.I., Land Agent, 15 Queen Street, Exeter
 1902 Drummie, Alex. C., Assistant Forester, c/o Mr. Harrison, 20 Oldgate Street, Morpeth

Date of
Election

- 1906 Duchesne, M. C., Land Agent, Crathie, Slough, Bucks.
 1905 Duff, Thomas, Assistant Forester, Woods Department, Apethorpe Hall Estate, Wansford, Northants.
 1906 Duff, James, Assistant Forester, Pilsley, Bakewell, Derbyshire
 1903 Duthie, J. Allardyce, Manager, Ben Reid & Co., Ltd., Nurserymen and Seedsmen, Aberdeen
 1905 Duthie, John, Assistant Forester, Brook Cottage, Ramsdell, Basingstoke, Hants.
 1906 Earle, A. B., Puddington Old Hall, Neston, Cheshire
 1898 East, William, Florist, Fowler Street, South Shields
 1905 Edmondson, F., Florist, Green Market, Newcastle
 1902 Eggar, J. Alfred, Land Agent, Farnham, Surrey
 1906 Eland, G., The Scrubbs, Harefield, Middlesex
 1892 Elder, William, Wood Manager, Thoresby Park, Ollerton, Notts.
 1891 Ellis, Thomas, The Larches, Hexham
 1902 Ellison, R. H., Head Forester, Bleach Green, Witton Gilbert, Durham
 1905 Ellison, Ed., Forester, Corballis House, Rathdrum, Co. Wicklow
 1904 Eltringham, Alfred, Accountant, 3 Marine Approach, South Shields
 1900 Elwes, H. J., F.R.S., Colesborne, Cheltenham
 1906 Embleton, Isaac, Assistant Forester, Linolds, Hexham
 1905 Emerson, Thos., Schoolmaster, Denton, Darlington
 1905 Evans, H., 55 Markham Avenue, Harehills, Leeds
 1904 Ewing, Guy, F.S.I., Land Agent, Edenbridge, Kent
 1906 Eyre, A. H., Forester, Stanway, Winchcombe, Gloucester
 1906 Eyre, A. W. J., Heath Bank, Longstone, Bakewell, Derbyshire
 1905 Faragó, Adelbert, Forest Nurseries and Seed Establishment to His Majesty the Emperor of Austria and King of Hungary, Waldsamen Klerganstalt mit Dampfetrieb, Baumschule, Samen-Handlung, in Zalaegerszeg (Ungarn) Hungary
 1906 Fater, George, Foreman Forester, Cantley, Doncaster
 1906 Feeney, Denis, Assistant Forester, Liverpool Corporation, Brinscall, Chorley, Lanca.
 1906 Fenton, A. Douglas, Land Agent, Maristons Estate Office, Roberough, S. Devon
 1898 Ferguson, John, Dene Croft, Jesmond Park East, Newcastle
 1902 Ferguson, R. C. Munro, M.P., Raith, Kirkcaldy
 1906 Ferguson-Davie, Major W. J., Buckstone, Upton Helions, Crediton, Devon
 1905 Fernie, Robt. L., Forester, Elveden, Thetford
 1902 Fife, H. L., Land Agent, Staindrop House, Darlington
 1905 Finn, M. Randolph, Property Manager, Argyle Street, Hebburn-on-Tyne
 1895 Fisher, W. R., M.A., St. John's College, Cambridge, Brasenose College, Oxford. Address: 6 Linton Road, Oxford
 1903 Fisher, C. B., Land Agent, Market Harborough
 1883 Fleming, William, Tudhoe, Co. Durham
 1899 Fogg, J. J., Ingleside, Heron Road, Meols, Cheshire
 1883 Forbes, William, Estate Office, Shotwick Park, Langhall, Cheshire
 1898 Forbes, A. C., Dept. of Agriculture, Dublin
 1902 Forbes, Robert G., Forester, Gulworthy, Tavistock
 1903 Forbes, A., Foreman Forester
 1890 Ford, John Walker, Enfield Old Park, Winchmore Hill
 1898 Forgan, William, Forester, Bowood, Calne, Wilts.
 1890 Forrest, A. J., Bedford Office, Thorney, Peterborough
 1888 Forster, W. A., Forester, Belgrave Lodge, Pulford, Wrexham
 1902 Fortune, Charles, Isalee, Coppice Drive, Harrogate
 1899 Foster, Christopher, 212 Pownall Green, Bramhall, Stockport

Date of
Election

- 1906 Foster, R. G., Burford, Oxon
 1904 Fotheringham, W. Steuart, Murthly, Perthshire, N.B.
 1894 Fox, Arthur, Assistant Forester, High Street, Sedgfield, Ferryhill
 1903 Foxton, J. T., Head Forester, Riverdale, Burbage, Buxton, Derby.
 1898 Fraser, John, Forester, The Little Hill, Leighton, Ironbridge, R.S.O.,
 Salop
 1904 Fraser, Wm., Assistant Forester, Lilleshall, Newport, Salop
 1906 Frith, W. E., Land Agent, The Quinte Estate Office, near Chirk, N.
 Wales
 1906 Fry, T. B., Morth Grange, Northlew, N. Devon
 1886 Gallie, George, Sledmere, York
 1899 Gallie, Alex., Head Forester, Estate Office, Somerley, Ringwood
 1899 Gamble, J. S., F.R.S., Highfield, E. Liss, Hampshire
 1903 Garnett, Thos., Sub-Agent, Ford Cottage, Lumley Castle, Chester-
 le-Street
 1899 Garratt, William, Land Agent, Melbourne, near Derby
 1902 Gibson, George R., Tyne Saw Mills, Hexham
 1903 Gibson, W. M., Privy Purse Office, Buckingham Palace, S.W.
 1906 Gibson, Henry, Assistant Forester, Pilsley, Bakewell, Derbyshire
 1902 Gilbert, John, Antony Estate Office, Treval, near Torpoint, R.S.O.,
 Cornwall
 1905 Gilbert, Arthur Chas., Assistant Land Agent, Antony Estate Office,
 Treval, near Torpoint, R.S.O., Cornwall
 1895 Gilchrist, John McBride, Forester, Kinnel Park, Abergyle, N.
 Wales
 1897 Giles, C. P., M.P., Copse Hill House, Wimbledon, Surrey
 1886 Gillanders, A. T., Forester, Park Cottage, Alnwick
 1901 Gilles, Alexander, J. P., Gateshead
 1892 Glen, D. A., Forester
 1902 Glover, F. R., Timber Merchant, Three Oaks, Lathom, near
 Ormskirk
 1902 Glover, Thomas, Timber Merchant, Delamere Villa, Lathom, near
 Ormskirk
 1906 Godley, Thos., c/o Godley & Goulding, Timber Merchants, Worksop
 1904 Gordon, Peter, Assistant Forester, Battersby, Ingleby Greenhow,
 York
 1901 Gott, Frank, F.S.I., Land Agent, 3 East Parade, Leeds
 1897 Gough, Reginald, Forester, Wykeham, York
 1904 Grace, H. W., J.P., Hallgarth Hall, Winlaton, Co. Durham
 1890 Graham, Joseph, Approach House, 105 South Woodbine Square,
 South Shields
 1894 Graham, David, Forester, The Green, Newbridge-on-Wye, Radnor-
 shire
 1901 Graham, W., Timber Merchant, Alnwick
 1896 Grant, William, Wood Bailiff, Aspinall's Farm, Almond Brook,
 Wigan
 1893 Gray, Joseph S., Fruitfield, Richhill, Co. Armagh, Ireland
 1901 Gray, Robert, Land Agent, Sherborne Park, North Leach, Gloucester-
 shire
 1902 Gray, Chas. A., Assistant Forester
 1894 Greene, T., Ghyll House, Wreay, Carlisle
 1899 Greenwell, His Honour Judge Francis John, Greenwell Ford,
 Lanchester
 1894 Greenwood, Charles H., Petworth Park, Sussex
 1903 Grenfell, Arthur P., Farrington Works, Shoe Lane, E.C.
 1882 Grey, C. G., 8 Lansdowne Terrace, Ballsbridge, Dublin
 1902 Griesdale, R. D., C.E., Deputy Waterworks Engineer for the Halifax
 Corporation, Halifax

Date of
Collection

- 1901 Gull, Sir Cameron, Bart., Frilham House, Yattendon, Berks.
1896 Gullachsen, L. H., 10 Pilgrim Street, Newcastle
1902 Gullachsen, L. W., 10 Pilgrim Street, Newcastle
1897 Guthrie, Captain, Linden Gardens, Harton, South Shields
1906 Gwyn, St. Charles B., Bulawayo, Southern Rhodesia
1900 Hadfield, T. W., Estate Office, Mere, Knutsford, Cheshire
1896 Hall, W. T., Highclere, Newbury
1906 Hall, Alexander C., Great Rollright, Chipping Norton, Oxon.
1906 Hall, H. J., Timber Merchant, Forest Hall, Newcastle-on-Tyne
1896 Hamilton, D., Knowsley, Prescot
1903 Hamilton, G. J. Balgowrie, Harrogate
1906 Haines, A. H. J., Lecturer, Agricultural College, Wye, Kent
1893 Hankins, Charles, Forester, Wordwell, Culford, Bury St. Edmunds
1903 Hannah, George, Head Forester, Ampton, Bury St. Edmunds
1888 Hanson, A., Bailiff, South Elmsall, Doncaster
1906 Hanson, Clarence O., Staunton, Coleford, Glos.
1902 Harris, H. E., New Lodge, Plaitford, Romsey, Hants.
1904 Harvey, John, Forester, Trentham Estate, Stoke-upon-Trent,
Staffordshire
1901 Hatcher, Bertram H., Forester, Poplars Green Lodge, Panshanger,
Hertford
1893 Havelock, Henry, Forester
1902 Hawshaw, J. C., Hollycombe, Liphook, Hants.
1903 Heaton, K., Land Agent, Alton, Hants.
1906 Hedefine, Ed., Castletown House, St. Aidan's Road, South Shields
1896 Hedley, T. A., Steward, The Hermitage, Barrasford
1893 Henderson, David, Forester, Bath House, High Melton, Doncaster
1904 Henderson, James, 13 Oxford Street, Whitley Bay
1906 Hendrie, Thos., Forester, Stanwick, Darlington
1903 Henry, Dr. A., 13 Westpark Gardens, Kew
1893 Herd, W. A., Nurseryman, Penrith
1894 Herd, Isaac, Nurseryman, Penrith
1885 Heskett, W. J., Land Agent, Penrith
1904 Hibberd, Thomas, jun., Assistant Forester, Bolton Abbey, Skipton
1906 Hicks-Beach, Major A. W., Manchester House, Atherstone
1896 Hill, Claud, Nurseryman, Stone
1896 Hilson, John, Forester, Pusey, Farrington, Berks.
1904 Hobbs, Francis, Land Agent, Crown Office, Monmouth
1904 Hollis, John, Forester, Sherington Park, Market Drayton, Shropshire
1906 Hollis, George, Forester, Stourhead, Leale, Wilts.
1906 Hopton, Charles, 67 George Street, Euston Square, N.W.
1904 Hornby, James J., Knowsley, Prescot
1906 Horner, John F. F., Mells, Frome
1906 Hotchkiss, J. Morgan, Land Agent and Architect, The Kirkhouse,
Brampton Junction, Cumberland
1899 Houlton, Colonel Archer, Hallingbury Place, Bishops Hatford,
Essex
1901 Howard, E. Stafford, C.B., Thornbury Castle, Thornbury, R.S.O.,
Gloucestershire
1904 Howard, A., Sutherland House, 3 Lloyds Avenue, Fenchurch Street,
London, E.C.
1906 Hoyland, C. Edward, Brierley Gap, Barnsley, Yorks.
1904 Huggins, David, Walshford, Wetherley, Yorks.
1889 Hull, Frank, Forester, Lilleshall, Newport, Salop
1904 Hull, George, Assistant Forester, Lilleshall, Newport, Salop
1903 Hutchinson, Wm., Assistant Forester, Knipton, Grantham, Lincoln-
shire
1901 Hyslop, James S., Land Agent, Middleton-in-Teesdale, Co. Durham

Date of Election	
1902	Imeson, John, Assistant Forester, Swinton, Masham
1903	Inglis, Alex., Forester, Bridge Hill, Belper, Derby.
1904	Innes, G. P. Mitchell, Land Agent, Craig-yr-Haul, Castleton, Cardiff
1905	Irish, Charles, Head Forester, Hinton St. George, Crewkerne
1900	Iveson, William, Auctioneer, Hexham
1905	Jackson, H. F., Land Agent and Accountant, Park Hill, Rochdale
1893	James, C. H., Rudchester, Wylam
1898	James, William, Naworth Estate Office, Brampton, Carlisle
1904	James, Arthur J., J.P., Edgeworth Manor, Cirencester
1894	Jamieson, D., Barroole Cottage, Foxdale, Isle of Man
1906	Jamieson, David, Junr., Assistant Forester, Drybrook, Ellwood, nr. Coleford, Gloucs.
1903	Jeffries, W. J., The Nurseries, Cirencester
1902	Jenkin, W. A., Land Agent, Liskeard, Cornwall
1899	Johnson, George, Assistant Forester
1902	Johnson, William, Land Agent, Trench Hall, Gateshead
1905	Johnson, George, Forester, Biningborough Estate, Shipton, Yorks.
1898	Johnston, Robert, Forester, Angus Cottage, Preston, Duns, N.B.
1898	Johnston, Andrew, Assistant Forester, Old Road, Studley, Calne, Wilts.
1903	Jones, Richard, Head Forester, West Dean Park, Chichester
1893	Kelly, J. G., West View, Pontefract
1904	Kendle, George Robert, Land Agent, Wilton, Salisbury
1896	Kennedy, John, Millgreen Cottage, Ingatestone, Essex
1903	Ker, A. P., Land Agent, Cattle Market, Hexham
1906	Keateven, Lord, Casewick House, Stamford
1895	Kidd, William, Forester, Harewood, Leeds
1904	Kimm, John J., Head Forester, Chesters, Humshaugh-on-Tyne
1904	Kininmouth, Wm., Assistant Forester, Wynyard Park, Wolviston, Durham
1904	Knollys, Cyprian R., Land Agent, Grange Estate Office, Alresford, Hants.
1897	Laidlaw, P. O., Stone Croft, Fourstones
1902	Laidlaw, John, Foreman Forester, Chatsworth Estate, Pilsley, Bakewell, Derby.
1902	Laidler, G. G., 40 Northumberland Street, Newcastle-on-Tyne
1897	Laine, F. J., Head Forester, Ladylands, Shorwell, Isle of Wight
1902	Laird, John, Forester, Powerscourt, Enniskerry, Co. Wicklow
1905	Langdale, Arthur O., B.Sc., 7 Framlington Place, Newcastle-on-Tyne
1901	Lascelles, Hon. Gerald, The King's House, Lyndhurst
1899	Laws, J. M., Washington Village, R.S.O., Co. Durham
1904	Learmont, John, c/o Wm. Learmont & Son, Larchfield Nurseries, Dumfries
1901	Lee, Henry, Malpas, Cheshire
1901	Lee, Edward S., Woodlands, Hexham
1902	Lees, Wm., Foreman Forester
1896	Legard, D. C., Heighington, Lincoln
1906	Lennard, Sir H., Bart., Wickham Court, West Wickham, Kent
1900	Lewis, Thomas, Fair Oak House, Roath Park, Cardiff
1902	Lewis, J. H., M.P.
1903	Lewis, H. C., Land Agent, Whittlebury, Towcester
1904	Liddell, George, The Grange, Kimblesworth, via Chester-le-Street
1890	Lincoln, Edward H., Cleadon, via Sunderland
1902	Linkill, Thomas, Mowbray House, 113 East Parade, Harrogate
1900	Little, Adam, Mousen Hall, Belford
1906	Llewelyn, C. Venables, Llysdyham, Newbridge-on-Wye, Radnorshire

Date of
Election

- 1903 Lloyd, Cyril, Assistant Forester, Fire Station, Moss Side, Manchester
1899 Lock, Hampton C., Head Forester, Middleton, Tamworth
1883 Lookhart, L. C., Solicitor, Hexham
1883 Lookhart, H. F., Hexham
1899 Lookhart, Peter, Land Agent, Estate Office, Corby Castle, Carlisle
1894 Lake, Thomas W., Forester, Greenshaw Plain, Hexham
1904 Luttrell, J. F., Dunster Castle, Dunster, Somerset
1902 Macdonald, George N., Forester, Raith, Kirkcaldy
1902 Macdonald, John, Assistant Forester
1905 Macdonald, H. M., c/o Mr. A. T. Gillanders, Park Cottage, Alnwick
1906 Mackintosh, Wm., Assistant Forester, Pilsley, Bakewell, Derbyshire
1904 Macky, M., Leather Merchant, 36 Highbury, West Jesmond,
Newcastle-on-Tyne
1891 Maister, C. L. N., Swinton Estate Office, Masham
1906 Mann, A. F., Eccleston Park, Prescott
1902 Mansfield, John Henry, Assistant Estate Agent, Howick, Leobury,
Northumberland
1906 Marillier, Frank Wm., Deva, Westlecott Road, Swindon
1892 Marsden, James, Assistant Forester, Clifton Castle, Bedale
1890 Marsh, W. D., Land Agent, Broughton, Skipton-in-Craven
1895 Marshall, George, Land Agent, Frimstone, Liphook, Hants.
1892 Marshall, T. D., Solicitor, King Street, South Shields
1898 Marshall, W. H., Place Fell House, Patterdale, Penrith
1899 Marshall, Peter, Forester, Euston, Thetford, Suffolk
1903 Marshall, F. C., Riseholm Grange, Lincoln
1903 Marshall, M. W., Timber Merchant, Godalming, Surrey
1899 Martin, Thomas, F.S.I., 90 Inderwick Road, Crouch End, N.
1891 Mason, John, Estate Office, Grantley, Ripon
1904 Mason, J. E., Horticultural Chemical Merchant, Barrow-on-Humber,
Hull
1883 Matheson, Thomas, Nurseryman, Morpeth
1903 Matthews, Councillor J. L. Hampton, Scalby House, Kent Road,
Harrogate
1902 Maude, A., Ivy Mount, Eastbourne, East Sussex
1899 Maudlen, J. C., 43 Osborne Road, Newcastle-on-Tyne
1904 Maw, Percival T., Land Agent, Holmesdale, Nutfield, Surrey
1906 Maxwell, The Right Hon. Sir Herbert, Bart., F.R.S., Monreith,
Whauphill, Wigtownshire, N.B.
1902 May, George, Simonside Hall, South Shields
1891 McAndrew, P., Forester, Prudhoe Hall, Prudhoe
1904 McBeath, David, Forester to Liverpool Corporation, Quarry Road,
Brinscall, Chorley, Lancs.
1900 McBride, D., Gardener, High Legh, Knutsford, Cheshire
1895 McCracken, William, Land Agent, Englesea House, Crewe
1899 McDougall, Alexander, Forester, Duncombe Park, Hemsley, R.S.O.,
York.
1905 McDowell, John, 58 Julian Avenue, South Shields
1903 McGibbon, R., Forester, Wentworth, near Rotherham
1905 McGlashan, John, Assistant Forester, Chatsworth Estate, Pilsley,
Bakewell, Derbys.
1902 McKechnie, Angus, Assistant Forester, c/o Mr. A. T. Gillanders,
Alnwick Castle, Alnwick
1900 McLean, Duncan, Forester, Brandon, Coventry
1905 McPherson, John, Forester, Wolverstone, Ipswich
1892 Menzies, James, Forester, Pitney, Langport, Somersetshire
1902 Methven, John, Thomas Methven & Sons, Nurserymen, Edinburgh
1899 Michie, James, Forester, The Nurseries, Orwell Park, near Ipswich
1904 Mildred, George B., Land Agent, Church Preen, Shrewsbury

Date of
Election

- 1899 Miles, Charles, Timber Merchant, Stamford, Lincolnshire
 1901 Miln, T. E., Nurseryman, Darlington
 1894 Milne, William, W. Fell & Co., The Royal Nurseries, Hexham
 1902 Milne, A., Nurseryman, 32 Hanover Street, Edinburgh
 1896 Milthorpe, John, Nurseryman, Gowlands, Westgate Road, Newcastle-on-Tyne
 1884 Mitchell, John, Forester, Strid Cottage, Bolton Abbey, Skipton
 1884 Mitchell, Francis, Park Farm Office, Woburn, Bedfordshire
 1902 Mitchell, F. W., Welbeck, Worksop
 1904 Mitchell, John, junr., Assistant Forester, Bolton Abbey, Skipton
 1906 Mitchell, Arthur, High Grove, Tetbury, Gloucestershire
 1899 Moffat, R., Head Gardener, Leazes Park, Newcastle-on-Tyne
 1899 Moir, E. McArthur, Deoban, Laxden Hill, Colchester
 1894 Molynaux, Job, Curraghmore, Portlaw, Ireland
 1902 Moore, Charles, Assistant Forester, Bedgebury Park, Goudhurst, Kent
 1906 Moore, A. Gordon W., Assistant Forester, West Stow, Bury St. Edmunds
 1896 Moran, J. A., Editor *Land Agents' Record*, 149 Strand, W.C.
 1900 More, W. H., Crown Receiver for Wales and County Monmouth, Noddfa, Harlech
 1904 Moreton, Lord, Sarsden House, Chipping Norton
 1903 Morrison, W. J., Head Master, Haydon Bridge Shaftoe Trust School, Haydon Bridge
 1901 Mortimer, M. W., Land Agent, Culford, Bury St. Edmunds
 1897 Moulst, John, Underhill, Low Fell, Gateshead
 1905 Mounsey, Harry, Assistant Forester, c/o John Johnston, 2 Graham Street, Longtown
 1902 Mowat, George, Assistant Forester, Cotgrave, Nottingham
 1902 Muir, John, Assistant Forester, Culshobben, Portwilliam, Wigtownshire, N.B.
 1895 Mulford, Fred, Timber Merchant, 1 Elm Grove Road, St. David's, Exeter
 1901 Munford, James, 143 and 145 Queen's Road, Westbourne Grove, Bayswater, London, W.
 1902 Munro, Hugh, Forester, etc., Garden Cottage, Holkham, Norfolk
 1906 Mutter, G. H., Land Agent, Burghley Estate Offices, Stamford
 1905 Napier, H. W., Land Agent, Ashton Court Estate Office, Bristol
 1899 Naylor, R. A., Cuerden Hall, Thelwell, Cheshire
 1905 Naylor, Henry, Timber Merchant, Driffeld, Yorks.
 1904 Neate, A. W., junr., Land Agent's Pupil, Newbury, Berks.
 1901 Nelthorpe, R. N. S., Scawby Hall, Lincolnshire
 1906 Newman, Sir Robt., Bart., Mamhead Park, Exeter
 1904 Newnham, J. H., Home Timber Editor, *Timber Trades' Journal*
 1902 Nichol, James, Forester, Croxteth, Liverpool
 1899 Nixon, J. J., Cambo, R.S.O., Northumberland
 1903 Nixon, George, Estate Office, Shawdon, Glanton, R.S.O., Northumberland
 1905 Norman, Robert, Assistant Forester, Ardgowan, Inverkip, Greenock, N.B.
 1905 Norton, Thos. H., Land Agent, 2 Down Street, London, W.
 1899 Oakley, John H., 10 Waterloo Place, Pall Mall, London, S.W.
 1906 O'Brien, H. H. Stafford, Blatherwycke Park, Wansford, Northamptonshire
 1903 Ord, George, 10 Kinfauns Terrace, Low Fell, Gateshead
 1895 Orkney, W. C., Surveyor's Office, Montrose Royal Asylum
 1898 Ormiston, Walter, Lee Walton & Co, Timber Merchants, Langley-on-Tyne

Date of
Election

- 1904 Orwin, C. S., F.S.I., Estate Office, Pantom, Wragby
1904 Osmond-Smith, F. H., Land Agent, College View, East Grinstead
1906 Osmond, Henry, 13 Bedford Circus, Exeter
1900 Pain, W. H., F.S.I., Land Agent, Carnarvon Estate Office, Bingham, Notts.
1905 Palfrey, Henry, Foreman Forester, Ampton Park, Bury St. Edmunds
1895 Palliser, James, Rose Bank, Blackhill, Co. Durham
1896 Palliser, William, Blackhill, Co. Durham
1900 Palliser, R. S., Copdock, Ipswich
1905 Parker, F. W., Parks Department, London County Council, 11 Regent Street, S. W.
1906 Parker, Oxley Durant, Sharpham, Devonshire
1906 Parry, J., Water Engineer, Liverpool Waterworks, Woodbury, Waterloo, nr. Liverpool
1903 Parsons, R. M. P., Land Agent, Misterton, Crewkerne, Somerset
1906 Payne, George, Forester, Thorney, nr. Peterborough
1900 Pearson, G., The Glen, Lancaster Road, Harrogate
1906 Pearson, J. W., Assistant Forester, Chesters, Humshaugh
1905 Pennell, W. R., Nurseryman, Lincoln
1905 Pennick & Co. Nurserymen, Delgany Nurseries, Co. Wicklow
1902 Perkins, Henry, c/o Messrs. Wood & Ingram, The Nurseries, Huntingdon
1902 Perkins, John Edward, Nurseryman, Billing Road Nurseries, Northampton
1902 Perkins, John Edward, junr., Nurseryman, Billing Road Nurseries, Northampton
1905 Petch, John S., P.A.S.I., Estate Office, Wensley, Leyburn, Yorks.
1896 Petrie, David, Westoe Hotel, South Shields
1900 Pewson, Leonard, 80 Cheapside, London, E.C.
1899 Philip, William W., Factor, Gigha, Argyleshire, N.B.
1906 Philpot, Clifford N., Surveyor, Dunsmore, Warlingham
1904 Piek, S., Nurseryman, 5 Leazes Terrace, Hexham
1902 Pike, Thomas, Saltwell Hall, Saltwell Lane, Gateshead-on-Tyne
1899 Pitcaithley, Alex., Forester, Jeannie Bank, Old Scone, Perth
1904 Pitt, Dr. J. Newton, 18 Portland Place, W.
1894 Pollard, Henry
1895 Pope, William, Gardener, Highclere, Newbury
1896 Pope, Alfred, Assistant Forester, White Crag, Timble, Otley, Yorks
1902 Popert, E. P., Superintendent Forester, Braceland, Colford, Glous
1902 Portal, Maurice, Land Agent, Estate Office, Beaufront Castle, Hexham
1895 Potter, Professor, Armstrong College, Newcastle-on-Tyne
1904 Powell, James, Caerphilly, Wales
1906 Pratt, Edward R., Ryston Hall, Downham, Norfolk
1900 Price, Jos., Estate Office, High Legh, Knutsford, Cheshire
1906 Price, M. P., Tibberton Court, Tibberton, S.O., Gloucestershire
1904 Pritchard, H., St. Fagans, Cardiff
1906 Purnell, Augustus, Forester and Timber Valuer, Ty Avon Riverside, Newport, Mon.
1905 Puttock, W. H., Billingham, Sussex
1900 Rafn, Johannes, Tree Seed Merchant, Skovfrøkontoret, Copenhagen —F.
1895 Ralston, W. H., Land Agent, Streatlam Castle, Darlington
1906 Ratcliffe, Thomas D., Building Surveyor, Tavistock
1904 Readhead, John, Shipbuilder, Rockcliffe, Westoe, South Shields
1893 Reed, J. T., Caldwele Villa, South Shields
1906 Reeve, William, Land Agent, Grenville House, Sonning, near Reading

Date of
Election

- 1902 Reid, Hugh, Forester, Ashton Court, Long Ashton, near Bristol
 1905 Remer, J. S., Derby Road, Canada Dock, Liverpool
 1902 Renton, George, Estate Agent, Grove Villas, Queen Parade, Harrogate
 1904 Renton, T. R. V., Surveyor and Auctioneer, Albert Street, Harrogate
 1906 Reynardson, Colonel Chas. Birch, Holywell Hall, Stamford
 1905 Richards, G. C. Smyth, Land Agent, Castle Hill, near South Molton
 1901 Richardson, C., Land Agent, 15 Barn Hill, Stamford
 1901 Richardson, E. C., Land Agent, 15 Barn Hill, Stamford
 1901 Richardson, C. E., Forester, Easton Hall, Grantham
 1906 Riddell, E. F., Cheeseburn Grange, Newcastle-on-Tyne
 1904 Riley, L. J. C., Agent, Patley Court, Ledbury, Herefordshire
 1892 Ritson, Morley, Timber Merchant, Hexham
 1890 Roberts, Thomas, Forester, Park Gate, Easeborne, Midhurst, Surrey
 1898 Roberts, John, Forester, Crown Lodge, Tintern, Chepstow
 1895 Robertson, Thomas, Woodlawn, Co. Galway, Ireland
 1901 Robertson, J. P., Forester, Chatsworth Estate, Edensor, Bakewell, Derby.
 1888 Robinson, J. F., Timber Merchant
 1900 Robinson, Robert, Head Forester, Angerton, Morpeth
 1882 Robson, J. W., Joseph Robson & Son, The Nurseries, Hexham
 1902 Robson, Robert, 42 Northumberland Street, Newcastle-on-Tyne
 1905 Robson, Joseph, Timber Merchant, Prudhoe-on-Tyne
 1904 Rogers, John P., Penrose, Helston, Cornwall
 1902 Rolleston, Sir John F. L., M.P., Glen Parva Grange, Leicester
 1891 Ross, George, Joseph Robson & Son, The Nurseries, Hexham
 1901 Royce, D. N., Auctioneer, etc., Oakham
 1901 Rundle, Edward C., Bedford Office, Tavistock
 1895 Rutherford, J. A., Land Agent, Highclere, Newbury
 1903 Salt, H. C., Land Agent, Barrington Park Estate Office, Burford, Oxon.
 1902 Santer, William, Timber Merchant, Hawkhurst, Kent
 1904 Saunders, A., Forester, Delamere Forest, Kingswood Cottage, Kingswood, Frodsham
 1904 Sawyer, J. A., Land Agent, Winchester, Hants
 1901 Schlich, Dr., Ferbys Lodge, 29 Banbury Road, Oxford
 1904 Scholfield, E. P., Estate Office, Somerley, Ringwood, Hants.
 1903 Schott, Dr. Peter Carl, Knittelsheim, Palatinate, Germany
 1883 Scott, John, Land Agent, Newton, Stocksfield
 1895 Scott, John D., Estate Office, Brushford, Dulverton
 1893 Scott, James, Timber Merchant, Hill Crest, Ryton
 1898 Scott, A., Forester, Southwick, Fareham, Hants.
 1902 Scott, John S., Estate Office, Keele, Newcastle, Staffs.
 1896 Seaton, A., Forester, Hawarden, Chester
 1904 Sewell, Wm. W. R., Brandlingill, Cockermouth
 1897 Shearburn, H., Munstead, Godalming, Surrey
 1901 Shearburn, R. B., The Hall, Snaith, R.S.O., Yorkshire
 1899 Sheriff, Stephen, The Bungalow, Westoe, South Shields
 1883 Shipley, Edward, 20 North Road, Darlington
 1898 Shortt, John, Forester, Blagdon, Cramlington, Northumberland
 1901 Short, George, Forester, Ravensworth, Gateshead
 1898 Simpson, W. A., Skipton Castle, Skipton, Yorks.
 1903 Simpson, Alderman David, C.C., Four Ash, Harrogate
 1906 Simpson, John Bell, J.P., Bradley Hall, Wylam-on-Tyne
 1904 Skewis, Edwin, Brendon, The Drive, Tonbridge
 1885 Slater, Herbert, Forester, Greenlands, Henley-on-Thames
 1901 Slater, Ed., Supt. Elswick Cemetery, Newcastle-on-Tyne
 1905 Slater, Andrew, junr., Estate Clerk, The Red House, Durrington, Salisbury

Date of
Election

- 1884 Smith, David, Woodman, Scremerston, Berwick-upon-Tweed
 1887 Smith, Stephen, Bailiff, Blenkinsop, Haltwhistle
 1888 Smith, William, Timber Merchant, Gunnerton, Barrasford
 1892 Smith, J. M., Kensington Terrace, South Shields
 1896 Smith, J. O., Derwentside Terrace, South Shields
 1901 Smith, James, Estate Bailiff, Matten, Corbridge-on-Tyne
 1903 Smith, Harry, Woodside Cottage, Scremerston, Berwick
 1904 Smith, Cuthbert, Land Agent's Pupil, Thorney, Peterborough
 1904 Smith, Chas., jun., Nurseryman, Grindleford Bridge, Sheffield
 1905 Smithson, John, Timber Merchant, Prudhoe-on-Tyne
 1906 Smythies, Arthur, Hilliers, Dolton, N. Devon
 1906 Smyth-Osborne, J. S., Ash, Iddeleigh, N. Devon
 1891 Spence, John, Timber Merchant, Ripon
 1900 Spencer, Thomas, Head Gardener, Goodrich Court, Ross, Herefordshire
 1904 Stamer, W. E., Land Agent, Lilleshall Lodge, Newport, Shropshire
 1904 Stanworth, D., Assistant Forester, Newport, Salop
 1903 Staton, John E., Schoolmaster, 64 Stalker Lees Road, Sheffield
 1904 Stenning, W. V. K., Halafor, East Grinstead
 1891 Stewart, Dr., Hexham
 1900 Stewart, Alexander, Forester, Shadwell Court, Thetford
 1905 Stewart, Edward, Nurseryman, Ferndown Nurseries, Wimborne
 1906 Stewart, James, Forester, Gilling Castle, Gilling East, Yorks.
 1902 Stock, W. F. K., County Analyst, Darlington
 1901 Stocks, Ben, Architect, St. Peter Street, Huddersfield
 1903 Stooks, J. E. H., F.S.I., M.R.A.C., Land Agent and Surveyor, 2 Palace Yard, Hereford
 1893 Storie, W., Forester, Whitway House, Newbury, Berks.
 1898 Storie, Wm., Head Forester
 1902 Storie, A. B., Forester, Pilley Green, East Dean, Chichester, Sussex
 1900 Straker, F., Angerton, Morpeth
 1906 Strutt, The Hon. Edward Gerald, Surveyor, 21 Finsbury Circus, London, E.C.
 1904 Studdy, T. E., Estate Office, Basing Park, Alton, Hants.
 1894 Surtees, R. G., Contractor, Colwell, Barrasford
 1894 Swales, John, Fowler Street, South Shields
 1900 Swinburne, Sir John, Capheaton Hall, Newcastle-on-Tyne
 1898 Swinney, William, 10 Wentworth Terrace, South Shields
 1893 Symm, John, Engineer, Newton, Stocksfield
 1906 Symons, Gilbert, Land Agent, 341 Eaves Lane, Chorley, Lancs.
 1906 Synes, H. D., Land Agent, Halkyn Castle Estate Office, Holywell, N. Wales
 1906 Tailford, James H., Assistant Forester, Chesters Lodge, Humshaugh
 1902 Tate, George, Forester, Grinkle Park, Lofters, York
 1887 Taylor, Thomas, Chipchase Castle, Wark-on-Tyne
 1898 Taylor, John
 1898 Taylor, John, Lansdowne House, South Shields
 1901 Taylor, John, Supt. St. Andrew's Cemetery, Newcastle-on-Tyne
 1902 Taylor, George, Assistant Forester
 1903 Taylor, Charles, Assistant Forester, Highclere, Newbury, Berkshire
 1903 Taylor, James, Forester, Hainton, Lincoln
 1904 Taylor, Robert, Assistant Forester, Etal, Cornhill-on-Tweed
 1906 Taylor, H. J., Timber Merchant, Driffeld, Yorks.
 1902 Temperley, Nicholas, J.P., 4 Carlton Terrace, Low Fell, Gateshead
 1906 Tench, Rowland, Land Agent, Knighton, Radnorshire
 1906 Terry, Ernest, Estate Agent, Great Finborough, Stowmarket
 1903 Thimbleby, A. C., 47 Queen's Road, Reading, Berks.
 1899 Thomas & Co., Ltd., Ceres Works, Liverpool

Date of
Election

- 1902 Thomas, J. H., North Lodge, Wimpole Estate, near Royston, Cambs.
 1904 Thomas, E. Aubrey, 6 Brechin Place, Gloucester Road, London, S.W.
 1906 Thompson, Thos. E., Estate Office, Jervaulx Abbey, Middleham, R.S.O., Yorks.
 1902 Thomson, John, West End Park, South Shields
 1901 Thomson, Robert, Woods Foreman, 57 Park Hill, Ampthill, Beds.
 1902 Thomson, F. J., Land Agent, Baggrow Brow, Brayton, Carlisle
 1902 Thomson, Walter, Castle Gardens, Alnwick
 1892 Thornton, Councillor, Thorney Terrace, South Shields
 1900 Thornton, George, Gardener, Ingleton, Darlington
 1906 Thornton, Richard, Gosforth, Newcastle-on-Tyne
 1906 Thring, Douglas T., Land Agent, Boughton House, near Kettering
 1903 Thwaites, William, Joiner, Swinton, Masham, Yorkshire
 1906 Thynne, Col. A., 50 Cadogan Square, London
 1906 Tilly, C. Wynn, Land Agent, Thorpe Perrow, Bedale
 1903 *Timber Trades Journal*, The Editor of the, 164 Aldersgate Street, London
 1901 Tomkinson, James, M.P., J.P., Willington Hall, Tarfally, Cheshire
 1893 Thomlinson, Wilson, Forester, Clumber, Worksop, Notts.
 1899 Totty, Harry, Forester
 1902 Towner, John, Assistant Forester, Maypole Lane, Goudhurst, Kent
 1904 Trussler, H., Foreman Forester, Bowdsey Manor, nr. Woodbridge, Suffolk
 1902 Tully, Jas. B., Abbotsford, Mahoon, East London, C.C., South Africa
 1905 Tully, Robert, 9 The Lawe, South Shields
 1901 Tuppeney, William, Assistant Forester, Seacox Heath Lodge, Hawkhurst, Kent
 1900 Turnbull, Andrew, Assistant Forester, Picktree, Chester-le-Street, Co. Durham
 1895 Turner, Warner, Land Agent, Welbeck
 1902 Twelves, William, Foreman Forester, Chatsworth Estate, Ashford, Bakewell
 1906 Veitch, P. C. M., Nurseryman, Royal Nurseries, Exeter
 1902 Wade, Alderman, North Road, Halifax
 1901 Wainwright, Ormond F., Forester, Belton, Grantham
 1890 Walker, J. J., Timber Merchant, Orchard House, Hexham
 1897 Walker, J. D., Solicitor, 21 Pilgrim Street, Newcastle
 1905 Walker, Sir Francis E., Bart, Swansfield House, Alnwick
 1891 Ward, D. M.
 1901 Ward, R. R., Morewell Farm, Tavistock
 1905 Wardill, W. E., Cragdale, Low Fell, Gateshead
 1905 Ware, J. G., Wyndham, Eaton Hastings, Faringdon, Berks.
 1903 Warnock, J., Government Timber Inspector, 173 Herbert Road, Plumstead, Kent
 1903 Waterer, F. Gomer, The American Nursery, Bagshot, Surrey
 1901 Watney, Herbert, M.D., Buckhold, Pangbourne, Berks.
 1900 Watson, John Graves, 11 Chester Crescent, Newcastle-on-Tyne
 1902 Watson, Thos., Steward, Model Farm, Porter's Park, Shenley, Herts.
 1895 Watt, J. W., Little & Ballantyne, Carlisle
 1896 Watt, Alex., Land Agent, The Grove, Ravenglass, Carnforth
 1899 Watt, George Frederick, Sturton House, Churchill, near Kidderminster
 1894 Watters, John, Forester, Ridley Hall, Bardon Mill, Carlisle
 1906 Weale, James A., Timber Merchant, Boundary Place, Liverpool
 1902 Weigall, A. G., Land Agent, Hardingstone, Northampton
 1903 Weir, Alex., Assistant Forester, Chatsworth Estate, Beeley, Rowley, Derbyshire
 1901 Wells, Ed. S., Assistant Forester, Flimwell, near Hawkhurst, Kent

Date of
Election

- 1901 Wells, Hugh, Assistant Forester, Flimwell, near Hawkhurst, Kent
 1905 Welsh, James, Nurseryman, 1 Waterloo Place, Edinburgh
 1902 Went, Robert T., Forester, Bute Workshops, Blackmeir, Cardiff
 1903 Wheeler, H. J., Nurseryman, Warminster
 1904 Wheldon, M. L., P.A.S.I., Land Agent's Assistant, c/o F. Handley, Esq., 17 St. Mary's, York
 1893 Whitaker, John, Forester, Abbeystead, Lancaster
 1902 Whitcombe, George E., Park Farm, Woburn, Beds.
 1890 White, William, Forester
 1899 White, Joseph, House and Land Agent, 58 King Street, South Shields
 1901 White, John, Forester and Bailiff, Appleby Hall, Doncaster
 1904 White, John, Assistant Forester, Wynyard Park, Wolviston, Durham
 1904 Whitehead, Robert Henry, Bede College, Whitley Bay
 1901 Whitmore, T. G., Timber Merchant, Bury St. Edmunds
 1895 Whittingham, W., Estate Office, Sledmere, York
 1892 Wilkinson, W., Assistant Forester
 1904 Wilkinson, C. J., Sebergham Castle, Dalston, Cumberland
 1906 Wilkinson, Wm., Assistant Forester, Liverpool Corporation, Brin-scall, Chorley, Lanca.
 1901 Williams, Jas. H., Assistant Forester, Staindrop, Darlington
 1886 Wilson, John, The Leazes Park, Newcastle-on-Tyne
 1894 Wilson, Henry, Architect, Hexham
 1901 Wilson, John, Harton, South Shields
 1902 Wilson, Joseph, Timber Merchant, Pelaw Grange Saw Mills, Birtley, R.S.O., Co. Durham
 1906 Wilson, James, Assistant Forester, Elton, Peterborough
 1902 Wilton, J. P.
 1897 Winder, James, Gardener, Howden Dene, Corbridge
 1898 Wiseman, Edward, Nurseryman, Elgin
 1898 Wood, George, Brandon, Suffolk
 1900 Wood, John, Estate Office, Brandsby, Easingwold
 1901 Wood, Leslie S., F.S.I., High Street, East Grinstead
 1902 Wood, H. C., P.A.S.I., Land Agent, Chester's Estate Office, Hums-haugh, R.S.O., Northumberland
 1903 Wood, W. J., Cabinet Manufacturer, 66, 68 and 70 Cuthbert Street, South Shields
 1906 Wood, Alfred, 68 Julian Avenue, South Shields
 1904 Woodcock, R. Frank, Land Agent, Haslemere
 1902 Wright, A. Ireland, 2 Portland Terrace, Newcastle-on-Tyne
 1904 Wright, N. J., Timber Merchant, Morpeth
 1906 Wright, Alfred, The Gardens, Eshott Hall, Felton, R.S.O.
 1906 Wroughton, R. C., 16 Spencer Mansions, Queen's Club Gardens, West Kensington, W.
 1902 Wylam, Ralph J., Assistant Forester, Chester Lodge, Lambton Park, via Chester-le-Street
 1904 Yorke, Maurice, o/o the Earl of Wemyss, 23 St. James' Place, S.W.
 1893 Young, T. J., College of Agriculture and Horticulture, Holmes Chapel, Cheshire
 1896 Young, Harry J., 32 Esplanade, Whitley Bay
 1902 Young, Henry B., Blanking Estate Office, Metheringham, Lincoln
 1902 Young, F. E., Land Agent, Londesborough, Market Weighton, Yorks.
 1906 Young, Colonel C. L., Secretary and Bursar, Haileybury College, Hertford

WRITE TO THE MANUFACTURERS.

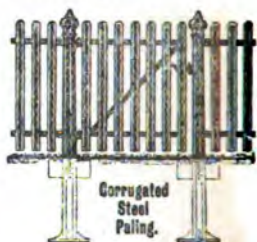
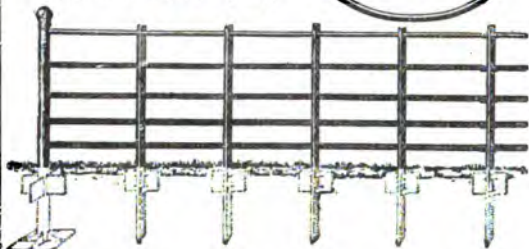
**BAYLISS,
JONES**

IRON & WIRE FENCING, &c.,

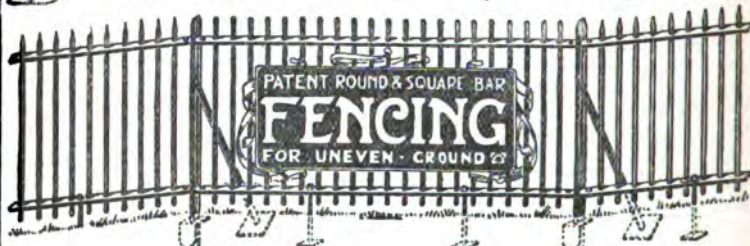


AND **BAYLISS,**

LIMITED.
MANUFACTURERS :—



Corrugated
Steel
Palisade.



Wrought
Iron
Tree-
Guards.

GATES,



RAILING.

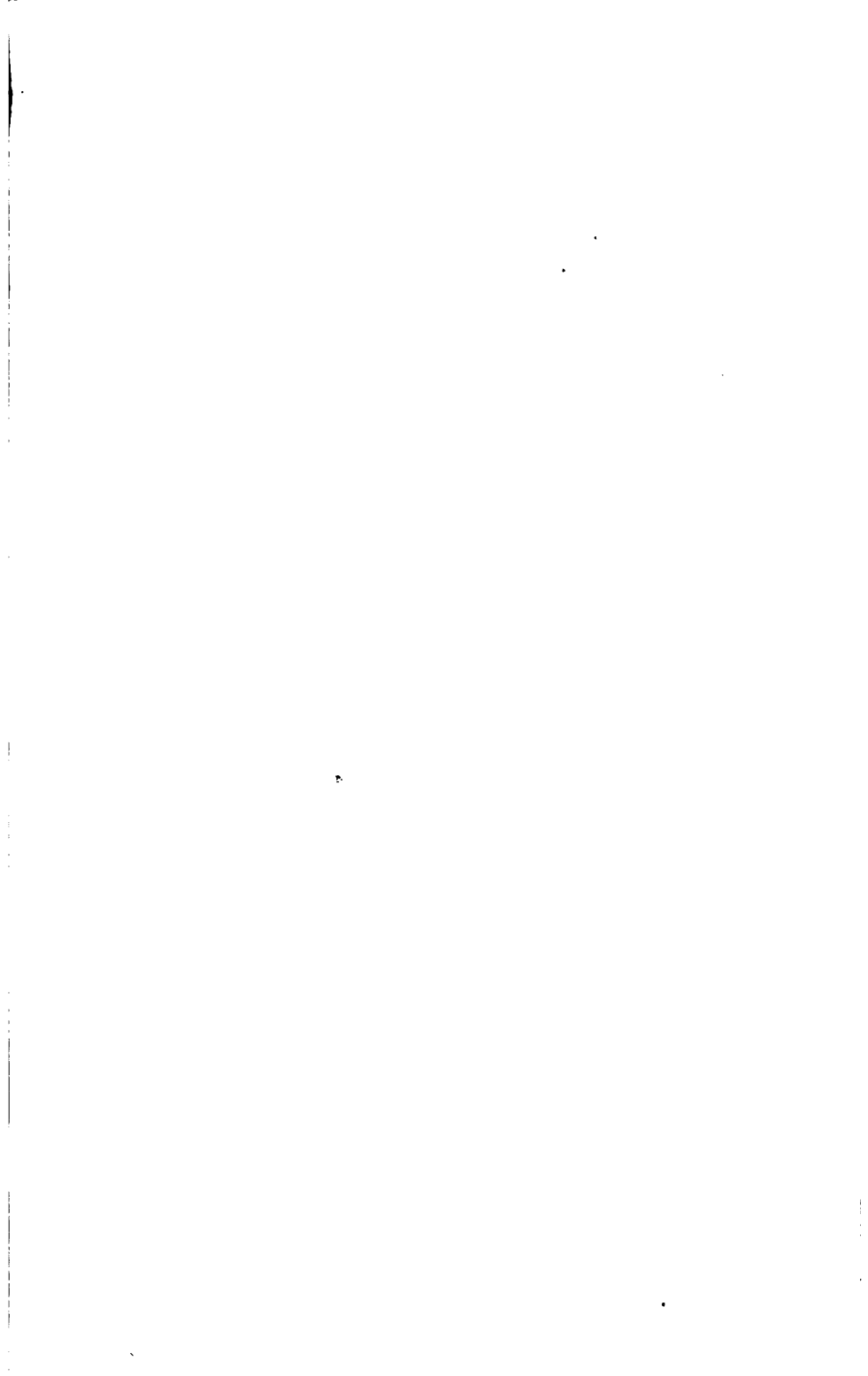
Catalogue Free.



WOLVERHAMPTON.

London Offices & Showrooms :—120 & 141, GARRICK ST., E.C.

PLEASE MENTION THIS PUBLICATION.



CONTENTS.

NOTICES TO MEMBERS	-	-	-	-	-	page
						143

CURRENT TOPICS :—

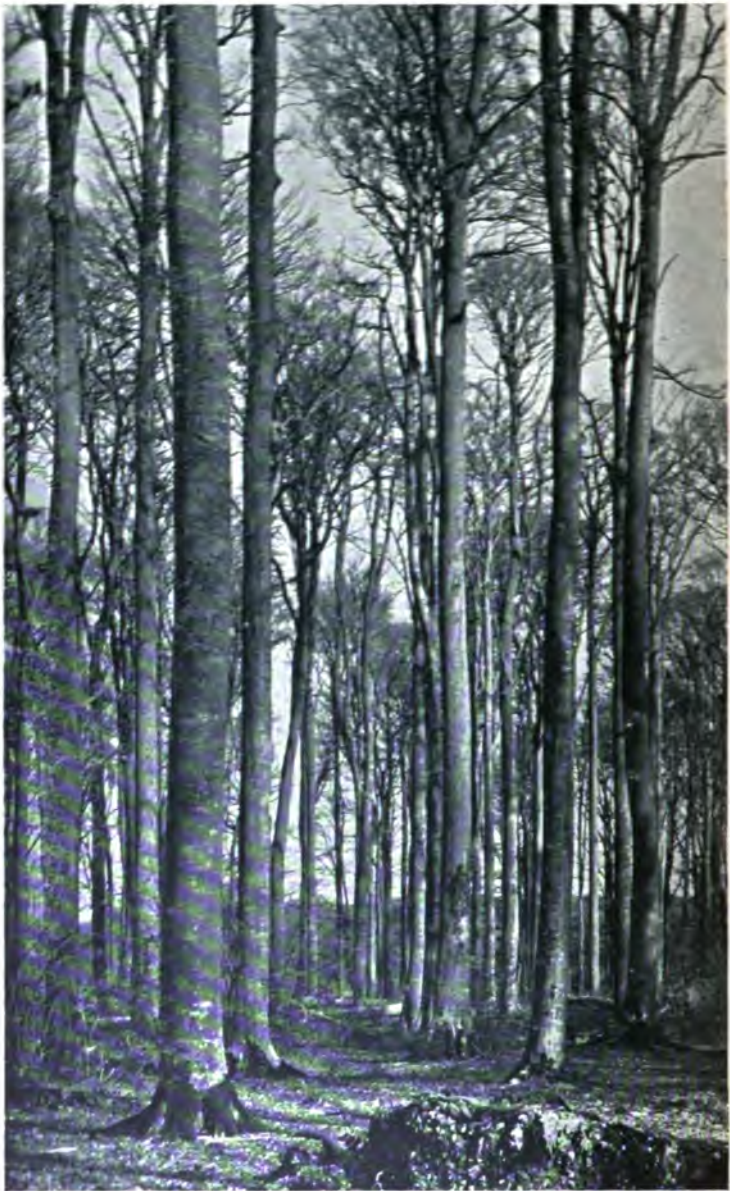
Mr. Wood's Lecture at the Surveyor's Institution	-	-	-	-	-	143
New Books	-	-	-	-	-	146
Transactions of the Royal Scottish Arboricultural Society	-					146
Tour of Dr. Henry	-	-	-	-	-	147
"The Indian Forester"	-	-	-	-	-	148
Bulletin Trimestriel de la Société Forestière de Franche Compté et Belfort	-	-	-	-	-	148
The Midland Re-Afforesting Association	-					150
Meeting of the Society of Economic Biologists at Cambridge	-					151
Forestry Course at Cirencester	-	-	-	-	-	151

ORIGINAL ARTICLES :—

The Duke's Osier-bed in an island of the River Thames between Kew and Richmond. By B. V. Ramaiengar	-	-	-	-	-	152
The Tavistock Woods. By W. Schlich	-					156
Tubney Arboretum and Nurseries. By W. R. Fisher	-					165
Observations on the effects of Spring and Autumn Frosts in 1905-1906, at Colesborne, Gloucestershire. By H. J. Elwes	-	-	-	-	-	169
Deodar in the Himalayas. By E. Mc. A. Moir	-					179
The Home Timber Trade	-	-	-	-	-	182
Notes from Derbyshire. By James P. Robertson	-					184
Old Oaks in Wentworth Park, Yorkshire. By Robert Mc. Gibbon	-	-	-	-	-	188
Timber Sales in Worcestershire. By J. B. Braid	-					189

REVIEWS :—

"Indian Trees." By F. B. M.	-	-	-	-	192
"The Trees of Great Britain and Ireland." By G. Claridge Druce	-	-	-	-	195
"Forest Protection." By W. G.	-	-	-	-	197
"Arboretum National des Barres." By H. J. Elwes	-				198



From a Photo by

Mr. C. H. GREENWOOD.

BEECH WOOD NEAR PETWORTH, SUSSEX.

From the 'Trees of Great Britain and Ireland, *vide* p. 196.

Quarterly Journal of Forestry.

No. 2.]

APRIL, 1907.

[Vol. I.]

NOTICES TO MEMBERS.

SIR HUGH BEEVOR, Bart., was co-opted as a member of the Publication Committee of this Journal, at a meeting of that Committee held at Derby, on the 15th February. He will act as Sub-Editor for Timber Sales.

Mr. A. SMYTHIES, of Dolton, S. Devon, has some seed of *Pinus Gerardiana* for disposal, and will send a few seeds (gratis) to members who may write to him for them.

Current Topics.

Mr. Wood's Lecture at the Surveyor's Institution.—Mr. L. S. Wood, on the 10th December, 1906, delivered a most interesting lecture on the "Improvement of our Woodlands," at the Surveyor's Institution. It was largely attended, especially by the younger surveyors, whom it is particularly desirable to interest in woodcraft, for they are the future managers of many of our landed estates. As the full report of the lecture and of the interesting discussion that ensued have not yet reached us, it is not now possible to do more than make a few remarks.

The lecturer began with discussing continental forestry, and stated that the continental forester works amid conditions that give him every opportunity of reaching a standard of excellence to which we, as a nation, can hardly expect to attain. The areas he has to deal with are, he said, larger than our own, and can consequently be treated with greater system and economy while continental forests are to a large extent the property of Government or of Municipalities, and their manager is consequently free from death duties, thoughtless extravagance, or sporting enthusiasm.

Now, in the first place, supervision is easiest over a small wood, and there is no reason why such a wood should not be well managed. Secondly, although there is a predominance of State forests over private forests in Russia and Greece, and of State and municipal forests combined over private forests in Spain and Portugal, in other continental countries the percentage of private forests of the whole woodland area is as follows: Norway, 85 %; Austria, 75 %; Belgium, 72 %; France, 64 %; Germany, 49 %

In Sweden there is only 20 % of State forest, 80 % being private or municipal. Undoubtedly forestry is a branch of economics that is best under State control; but, although the finest examples of successful forest management are under State agency, many fine continental forests belong to private owners, excellent examples of which may be seen at Mirwart and Villers-la-Ville, in Belgium, in many silver-fir forests in the Vosges Mountains, in the Fürstenberg forests in the Grand Duchy of Baden, the forests of the Bismarck family, near Bremen, many forests in Austria, and elsewhere.

As regards death duties, I have not heard that our continental neighbours are exempt from this contribution to the State, though I fully agree that by overburdening land with taxes we should not kill the goose that lays the golden eggs. Foresters on the continent are as keen sportsmen as ourselves, while instances of reckless extravagance are not confined to British landowners, many of whom are thoughtful economists. We have, in Britain, one great advantage for woodland management, in the law of entail. It keeps the land together, and sends the younger sons, after a good education, out into the world, to work in our Indian Empire and numerous colonies, however tropical and malarious they may be. In most continental States landed property is divided by law among the heirs of a deceased proprietor, and this results either in checking population, or in great sub-division of the land. Whatever benefits or disadvantages there may be in sub-dividing the land as far as agriculture is concerned, I leave to agricultural experts to decide, but there can be no doubt that minute sub-division of woodlands is not beneficial to a country. We have a glaring instance of this in Ireland, where the climate is essentially the

best in Europe for the growth of trees, but where immediate and energetic State action alone, as was recommended by Dr. Schlich to Lord Clarendon in 1885, can save the existing woods or add appreciably to their area, already reduced to the vanishing point. In France, the sub-division of agricultural property has gone so far that the population is stagnant, and only kept from reduction by the influx of foreigners.

Our law of entail is further supplemented by the fact that in many unentailed estates, in practice, only the personal property is distributed among the heirs, the land being left intact to the eldest heir direct. Our landowners, and especially those who find a pleasure in residing on their estates—and what countryman loves the country more than Britons—are generally shrewd enough in the management of their property. If once it be proved to their satisfaction that timber will become much more valuable in the future than at present, they will certainly undertake the systematic management of their woodlands. It was the depreciation in the value of wood, consequent on the abolition of wooden ships, the free import of foreign timber and the improvement in communications, that for the last fifty years has caused low prices of forest produce, and has largely led to the deterioration of British woodlands. The demand for timber is, however, increasing throughout the world, and supplies are now becoming precarious, so that prices must rise.

Dr. Schlich foretold this in his lecture in 1897 at the Imperial Institute, on "The Timber Supply of the British Empire." Mélard, in June, 1900, gave an address to the International Silvicultural Congress at Paris, on "Insufficiency of the production of timber in the world," and this was followed in March, 1891, by Schlich's lecture to the Society of Arts, on the "Outlook of the world's timber supply," which showed conclusively that the only certain prospective large supply of ordinary building timber for our use is in the Dominion of Canada, which supply is so largely tapped by the United States, that a timber famine is clearly foreshadowed in the immediate future.

Every woodland owner in the British Isles, including the Crown and other corporate bodies, has therefore the greatest interest in maintaining and extending his woodlands. Instead of lamenting that we have not larger areas of State

forest, we should proceed to deal with our actual resources in the best possible way. This may involve the purchase by the State of extensive areas of derelict wasteland, the owners of which have not the means of planting; but as regards existing woodlands, at any rate, and adjoining small areas of wasteland, we may confidently leave the matter to the present owners.

The "Timber News and Sawmill Engineer," in its issue of the 2nd of February, states that "an unusually large quantity of timber has recently been disposed of, and at higher prices than have probably been realised for home-grown wood." At Hinton, Somersetshire, beech at 1s. 3d., ash at 2s. 9d. At Milton in the same county, elm at 1s. 6d., oak at 2s. At Kinorty, near Dundee, Scots pine at 1s. 6d., larch at 2s., beech at 20s. per ton, ash at extreme prices (not given). Stoke Edith, Herefordshire, £2,167 for a quantity of timber, prices not specified. This paper also recommends landowners to plant forthwith—in view of the approaching scarcity—oak, ash, larch and Scots pine, and, in a smaller way, elm, beech, sycamore and sweet chestnut.

New Books.—The following new books on forestry and kindred subjects appeared during the Christmas vacation; reviews of them will be found later on in this Journal.

"INDIAN TREES," by Sir D. Brandis, K.C.I.E., F.R.S., is a splendid book, well illustrated, and the result of eight years hard work at Kew, together with the accumulated experience of the long years during which the author worked at the organisation of the Indian forests. It is published by Constable & Co., London. Price 22/-.

"THE TREES OF GREAT BRITAIN AND IRELAND." Part I, by H. J. Elwes, F.R.S., and A. Henry, M.A. This splendid work, beautifully illustrated, is being privately printed, and copies may be obtained from Mr. J. Edwards, Colesborne, Cheltenham. Price £15 15s.

SCHLICH'S "MANUAL OF FORESTRY," Vol. IV., Forest Protection, by W. R. Fisher, published by Bradbury, Agnew & Co. London. Price 12/-.

Transactions of the Royal Scottish Arboricultural Society.—Vol. XX., Part I of the Transactions of the

Royal Scottish Arboricultural Society is the first part of a half-yearly publication, edited by Colonel Bailey and Mr. Galloway, which greatly resembles our own Journal. There are 136 pages, with a few illustrations, including a capital coloured full page plate representing the larch sawfly, *Nematus Erichsoni*, Hrtg. Dr. MacDougall has written an admirable paper on the life-history and depredations of this insect, which was at work last summer over a considerable area in Cumberland. There is also a paper by Sir John Maxwell on the planting of high moorlands, taking as an example the planting of the Hertogenwald Moors in Belgium, which our society visited in 1905. There are also notices by J. S. G., of Schlichts' "Manual of Forestry," Vol. I, 3rd edition, Forest Policy in the British Empire; by Mr. Fraser Story, on the Castle Hill working-plan; notes on *Larix Leptolepis*, Siebald, by K. Kumé, chief of the Imperial Bureau of Forestry, Tokio; on the Novar system of combating larch disease, by J. Nisbet, D.Sc., as well as on continental forestry in 1906, by the same writer. An account of the 29th annual excursion of the Society in Northumberland and Durham is written by Mr. Galloway. There are also many other notes and reports, including "The creosoting of home-grown timber," by W. B. Havelock. The Transactions form a very useful volume, showing a marked improvement on preceding ones.

Tour of Dr. Henry.—Dr. A. Henry has just returned from a six months' tour in North America, Spain, Corsica, Italy, and Algeria. In North America he visited the forests of the Pacific slope from Montana to California, and paid particular attention to the western larch, to *Chamaecyparis Lawsoniana*, and the red wood. He is also the first botanist from Europe to see *Picea Breweriana*. In Minnesota he studied *Pinus Banksiana*. In Spain he visited the three districts where *Abies Pinsapo* occurs. In Corsica he paid particular attention to *Pinus Laricio corsicana*. In Italy he saw the fine silver-fir forests at Vallambrosa and Camaldoli. In Algeria he saw a good deal of the cedar forests, and of the fine oak forests (*Q. Suber*, *Q. Mirbeckii*, and *Q. castaneaefolia*), but, on account of heavy snow, was unable to ascend Mt. Babor, on which grows *Abies numidica*.

"The Indian Forester."—The December Number of "The Indian Forester" contains a paper by Sir D. Brandis on a spruce growing in the Chumbi Valley of the Eastern Himalāyas, the name of which is uncertain, but, as suggested by Dr. A. Henry, it may be *Picea morindoides*, Rehder (Sargent—"Trees and Shrubs," t. 95. t. 48). A good account of Padawk (*Pterocarpus dalbergioides*, Rxb.) in the Andaman Islands is written by F. H. Todd. The forests of this valuable timber tree apparently produce sufficient natural seedlings to give a steady yield, provided fire conservancy is successful and the blanks caused by fellings are sown or planted. Except in very dry localities, where the minimum girth limit for felling is 7 feet, 8 feet is given as the girth below which no tree is to be felled. A system of selection fellings has been introduced, the forests being gone over every fifteen years, half the period it takes for a Padawk $6\frac{1}{2}$ feet in girth to attain to $7\frac{1}{2}$ feet. Mr. F. Trafford has supplied a short paper with two illustrations on Timber Work in the Andaman Islands. The rest of the number consists of reviews, correspondence, and extracts from other publications, including an important one from the "Pioneer" on the preparation of African big game.

The most important of the reviews deals with S. Eardley Wilmot's "Notes on the influence of Forests on the Storage and Regulation of Water-Supply," Forest Bulletin No. 9, Government of India Press, Calcutta. Forest officers in India are so occupied with their present duties as sometimes to overlook what has been done by their predecessors, and the investigations to ascertain the effects of forests on water-supply by Sir D. Brandis and Colonel Bailey in the early eighties of last century are not referred to by Mr. Wilmot.

Professor Vines' admirable account of the late Professor Marshall Ward's life, which appeared in "Nature," is reproduced in the December Number of "The Indian Forester." This is the best way of showing the great love and esteem felt for Ward by Indian foresters, as no one in India could have access to the data from which Professor Vines wrote his sympathetic eulogium.

Bulletin Trimestriel de la Société Forestière de Franche Comté et Belfort.—This French Forest Society, with

which our own is affiliated, also publishes a Quarterly Journal, and No. 8, for December, 1906, contains several interesting papers, and two full-page illustrations. The first plate represents a strong *déracineuse*, or tripod lever, employed for extracting coppice stools from land to be converted into pasture. The other plate represents a forest in Cochin China.

Mr. Jolyet, the Professor of Silviculture at Nancy, has written a paper on exotics cultivated in the north-east of France, and especially on conifers that may be introduced into coppice-with-standards. His ideal is to discover a conifer which attains a large size without taking up too much room and killing the underwood. He recommends fox-tail pine (*Pinus aristata*, Engelm.) *Picea Omorika*, Pancic, and *Tsuga Pattoniana*, SÉNÉCL. As regards larches, which of all conifers are probably best suited for the purpose, he has at present no preference for any particular species.

M. C. D. gives an account of a silver-fir wood in the Doubs mountains of 350 acres (Revenu d'une sapinière). Taking a compartment of 15 acres, the crop on which he carefully measured in 1875, when it contained 1,282 trees from 2 feet 9 inches to 5 feet 10 inches in girth, with a volume of 26,722 cubic feet (solid) and worth £349, he finds that in 1906 it contained 2,349 trees from 2½ feet to 7 feet 2 inches in girth, with a volume of 68,483 cubic feet, and worth £1,006. During this period he has felled 127 trees, containing 5,890 cubic feet, and sold them for £86. We find, therefore, that the number of trees has nearly doubled in thirty-one years, and their volume nearly tripled, whilst the average value of the standing trees has increased. Finally, the capital value of the trees has augmented at compound interest at 3¾ per cent., and would have been 4 per cent., had no trees been felled. How, he asks, could land at 1,100 feet altitude be made to yield a higher interest, or be more profitably employed than in growing silver-fir? The system adopted is selection, and the regeneration entirely natural, so that the expenses are confined merely to supervision and taxes. This, it should be noted, is a privately owned woodland.

The Annual Meeting and Excursion of the Société Forestière de Franche Comté et Belfort will be held at Leviers, Doubs,

and in Switzerland, on the 1st July and following days. Any member of the Royal English Arboricultural Society who wishes to attend should apply for particulars to Mons. Rudault; Leviers, Doubs, France.

The Midland Re-Afforesting Association.—There have recently been several papers in the London "Tribune" on the work of replanting the Black Country, and it may interest our readers to know how this work was started. In the winter of 1894, I noticed that trees were growing on an abandoned slag heap in the Mirwart forest, in the Belgian Ardennes, then, as now, managed by Dr. Schlich. I had also noticed trees growing on slag heaps in the Forest of Dean, and I have since seen that similar slag heaps near Valenciennes are artificially stocked with alder, and present a green mass of foliage among the surrounding unsightliness of the surface above the French coal mines. Mr. F. Harbord, the chemical analyst at Coopers Hill, to whom I mentioned these facts, suggested that I should go with him to Birmingham on a visit to the Black Country, where we were most hospitably received by Mr. A. E. Tucker, F.I.C, and by other gentlemen in the Black Country. With Mr. Tucker, who has a detailed knowledge of the old pit-banks, we visited a number of these, and considered that they could profitably be planted, judging from the actual condition of ash, sycamore, alder and poplars growing in the grounds of Dudley Castle and elsewhere in the smoky atmosphere. Conifers do not thrive there, though possibly Austrian pine might live, and certainly experiments might be made with several species of trees, a list of those adapted to grow in smoky air being given in my book on Forest Production.

The result of this visit was an article in the "Daily Chronicle," which attracted much attention, and a paper appeared in the "Spectator," on the 25th August, 1894, on "The Restoration of Scenery," which warmly advocated the replanting of the Black Country. The Government of Lord Rosebery then deputed Mr. E. Stafford Howard, C.B., Commissioner of Woods and Forests, to visit the Black Country, which he did with Mr. Tucker, and reported that there was an area of 14,000 acres of waste land there available for planting, but that the

work should be left to local effort, especially to the town of Wolverhampton.

Nothing more was then done, and the matter dropped till 1902, when Mr. Herbert Stone, the Author of the "Timbers of Commerce," enquired about it from me, and I recommended him to see Mr. Tucker on the subject. Mr. Stone and Mr. Tucker associated themselves with Mr. P. E. Martineau, an eminent geologist, and this gentleman prepared a map of the pit-mounds, and estimated their area at about 30,000 acres, more than double the previous estimate. This map, and an interesting paper on the re-afforesting of the Black Country, with illustrations showing bare pit-banks and others that had been planted, was published by "Pearson's Magazine." I have a copy of this article, but no dates are given. Meanwhile, by the exertions of these three, the Midland Re-afforesting Association was founded, with Sir Oliver Lodge, F.R.S., as President, and Mr. Stone and Mr. Martineau as Honorary Secretaries.

The work is now progressing, several pit-banks having been successfully planted, and Mr. Stone writes that next autumn there will be as much planting as the Association can deal with. Willows do very well on the pit-mounds, and are easy and cheap to plant, so that friends of the Association who can supply cuttings of *Salix alba* might write to Mr. Stone, Bracebridge Street, Birmingham, who requires a large number of these as well as 1 year seedlings of alder, sycamore, wych-elm, ash, and plane.

Meeting of the Society of Economic Biologists at Cambridge.—This Society held its Annual Meeting at Cambridge during the vacation. Mr. A. E. Shipley, F.R.S., was elected President for the year, and a number of interesting papers were read. Great hospitality was shewn to the members of the Society by Christ's College. As the report of the proceedings will not be out before we go to press, an account of the meeting will be deferred till our next number.

Forestry Course at Cirencester.—Mr. P. T. Ward, F.S.I., one of our members, has been appointed temporarily to take charge of the forestry course at the Royal Agricultural College, Cirencester. Another of our members, Mr. F. H. Osmond-Smith, is also a candidate for the permanent post, which is still unfilled.

Original Articles.

THE DUKE'S OSIER-BED BY THE RIVER THAMES BETWEEN KEW AND RICHMOND.

THIS osier-bed is situated on an island in the bed of the River Thames opposite Isleworth. It belongs to the Duke of Northumberland, and is now rented by Mr. Moore, who has also 300 acres of farmland and orchard on the Syon Hill estate belonging to His Grace. The area of the osier-bed is about $6\frac{1}{2}$ acres.

LOCALITY.—Being in the tidal portion of the river, the area is flooded during high tides. During the spring tides there may be as much as 3 to 4 feet of water on the land. The soil is a rich stiff loam, being the accumulation of alluvial deposits brought down by the river.

DESCRIPTION OF THE GROWING STOCK.—The stand consists entirely of the common osier willow (*Salix viminalis*), and is worked to produce rods fit for making small baskets. There is a good system of open ditches to remove excess of water, so that the land is very well suited for the growth of this kind of willow. The area has been an osier-bed for a very long time, and some of the old stools are about 2 feet in girth, perfectly sound, and yielding as good rods as ever. On one of the old stools nearly 75 shoots were counted, the centre ones are now (August) already about 9 feet high, and they will be 11 feet before the end of the growing season. The stools are 18 inches high, and stand, roughly, about 18 inches apart, so that there are 19,360 stools per acre. In the South-east corner of the area there is a small clear space where the rods are stacked. Here the bunches of rods are left with their butt-ends standing in moist soil until they are peeled; and there is also an arrangement to admit or let off water according to requirements.

METHOD OF WORKING.—Dr. Nisbet, in his *Forester* (Vol. II., p. 486), has described in detail the general management and working of osier-beds. Reference may also be made here to the leaflet No. 30 of His Majesty's Agricultural Department.

The area was rented by the present tenant six years ago.

Since then he has done a good deal of planting. He has planted nearly 30,000 cuttings during the last six years.

The whole area is worked annually. It is a system in which no distinction can be made between forestry and agriculture. The harvesting of the crop is commenced in the latter part of December or early in January, and is completed in about five weeks. Care is taken to cut the rods clean close to the edge of the stool from which they spring. As soon as the rods are cut, they are tied up in small bundles of 20 inches in circumference near the butt-end, and are at once carried off to the stacking ground. They are there assorted into five sizes according to their length, and tied up in bundles (locally called bolts) of 40 inches circumference about a foot from the butt-end. The butts are left standing in the moist soil until Easter, when they are peeled.

Planting is done soon after the crop is harvested, *i.e.* about the middle of February. As many of the best one-year old shoots as are required are used for planting. These are merely stuck about 9 inches deep into the ground. In some osiers-beds an iron dibbler is used to bore a hole before the cutting is planted, and only shoots of one or two feet in length are used.

Weeding is done soon after the peeling is completed, *i.e.* about the end of May.

UTILIZATION OF PRODUCE.—The newly planted cuttings, 9 to 11 feet high, will have grown a couple of feet during the year, and then they are too big to be used for making small baskets. These large rods (over 11 feet in length) are peeled and sold. The rest of the crop is all used for making small baskets for use on the Syon Hill Farm.

The crop is assorted into the following classes :—

- (1) The first Size.—Rods over 11 feet in length. These are obtained chiefly from the year's plantings, and therefore practically two-year old shoots.
- (2) Great.—Rods between 9 to 11 feet in length.
- (3) Middle.—Rods between 7 to 9 feet in length.
- (4) Threepenny.—Rods between 5 to 7 feet in length.
- (5) Small.—Rods below 5 feet in length.

The first four classes are peeled by means of a simple instrument called a "Brake;" and the last class is not peeled.

This classification, which slightly differs from that given by Dr. Nisbet, is the one now used in the London market. No use is made of the bark.

EXPENDITURE.—All the operations are carried out by piece work.

(a) The cost of cutting is six shillings per score of bolts of various sizes. These are generally about 20 inches in circumference near the butt end. This charge includes the cost of carriage of the bolts to the stacking ground.

(b) The sorting costs five shillings per score of bolts of 40 inches circumference; so that the number of bolts for which sorting charges are paid is exactly half the number for which cutting charges are paid.

(c) PEELING.—The cost of peeling varies according to the class of bolts. On an average it costs 10d. to peel a bolt.

(d) BASKET-MAKING.—It costs 7½d. to make a bushel size basket, having alternate bands of peeled and unpeeled rods.

(e) The cost of planting is half-a-crown per 1000 cuttings.

(f) It costs £5 every year to weed the whole area.

YIELD.—The yield in quantity of material is 750 bolts of green unpeeled rods of 40 inches girth near butt end, *i.e.* 115 bolts per acre. These 750 bolts of unpeeled rods yield 60 bolts of peeled rods of the first size, 500 bolts of peeled rods of other sizes, and 100 bolts of unpeeled rods of the "small" size. Thus it will be seen that 6 bolts of unpeeled rods give 5 bolts of peeled rods. Out of the last 600 bolts 5,000 baskets are made for use on the farm.

The average weight of a bolt of peeled rods (in August) is 56 lbs., and of a bolt of "small" rods 28 lbs. The total yield in weight is 15 tons 5 cwt., or 2 tons 7 cwt. per acre. The yield in volume of a spruce wood on the best locality worked under a rotation of 100 years is 14480 cubic feet per year per acre (*vide* Dr. Schlich's *Manual of Forestry*, Vol. III., p. 369); and assuming 32 lbs. as the weight of a cubic foot of spruce wood, the yield in weight is 14480 × 32 lbs., or 2 tons 4 cwt. per acre per annum. A very favourable comparison indeed.

FINANCIAL RESULTS.—The following table shews the income and expenditure for the year 1905:—

EXPENDITURE.

ITEM.	AMOUNT.
Rent ... ..	... £15 0 0
Rates and Taxes ... ..	... 1 0 0
Cutting 1,500 bolts at 6/- a score	... 22 10 0
Sorting 750 bolts at 5/- a score ...	... 9 7 6
Peeling 560 bolts at 10d. per bolt	... 23 6 8
Making 5,000 baskets at 7½d. each...	... 156 5 0
Planting 5,000 cuttings at 2/6 per 1000	... 0 12 6
Weeding ... ..	... 5 0 0
Trenching, etc. ... ..	... 3 8 4
	<u> </u>
Total ... ..	... 236 10 0
Balance for good	... 100 0 0

Total ...£336 10 0.

INCOME.

ITEM.	AMOUNT.
By selling 60 bolts of 1st size rods at 8/- per bolt ... ..	... £24 0 0
„ Value of 5,000 baskets at 15/- per doz.	312 10 0

Total ...£336 10 0

Net Revenue is £100, or £15 7s. 8d. per acre.

GENERAL REMARKS.—Dr. Nisbet gives the yield as 5 to 10 tons per acre, and a net revenue of £15 per acre. The same revenue here for only $2\frac{1}{2}$ tons per acre is due to the high price of baskets near London.

I must take this opportunity to express my indebtedness to Sir Dictrich Brandis for having procured me the necessary permission to see the osier-bed; and I am thankful to Mr. Moore of the Syon Hill Farm for giving me the details of information on the working of his osier-bed, matters which not all private owners are ready to reveal to outsiders.

Kew, 2nd Sept., 1906.

B. V. RAMAINGAR.

THE TAVISTOCK WOODS.

THE PROPERTY OF HIS GRACE THE DUKE OF BEDFORD.

THE Royal English Arboricultural Society paid a visit to these woods in the summer of 1906, and accounts of it have been published on pages 104 to 107, and on pages 60 to 67, of the *Quarterly Journal of Forestry* for January, 1907. Under these circumstances it would appear superfluous to deal again with the subject. However, Mr. Fisher, the new Editor of the Journal, seems anxious to have a further account of the interesting work in the Tavistock woods which have been carried out during the last 8 or 9 years. In acceding to this request I need, however, not refer again to preliminary matters, such as the position of the woods, roads, soil, climate, markets, etc., but restrict my remarks to a general description of the forest growth, the arrangements for the management of the woods, and a summary of the work actually carried out.

It is well known that His Grace the Duke of Bedford takes a great interest in the management of his landed estates. In devising his scheme of improvement, the forests were not overlooked, and in the beginning of 1898 I was invited by the Duke's Chief Agent, now Sir Walter Lawrence, to examine and prepare schemes of management for them. I commenced with the Tavistock Woods, and on the 20th May, 1898, I sent in my suggestions. In preparing the latter I had the inestimable help of Mr. Edward Rundle, the Agent at Tavis-

tock, who entered most heartily into the business, went himself round the woods with me, and favoured me with a mass of local information, without which it is impossible to draw up a sensible working-plan for any forest. Indeed, it may be said that a forest expert preparing a working-plan relies in the first instance on the information given to him by the local manager. No sensible man would overlook the importance of this. At the same time, the expert can bring to bear upon the subject his professional knowledge and general experience gained under varied conditions, so that the administration of the woods under consideration may distinctly benefit by his advice. While local knowledge must, as already stated, be the basis of a working-plan, it cannot be expected that local managers should possess that freedom from personal fancies with which an outside expert will approach the subject, provided always that he has a sufficiently comprehensive knowledge of forestry, and varied experience gained elsewhere. But, to proceed to business :—

GENERAL DESCRIPTION OF FOREST GROWTH IN THE
TAVISTOCK WOODS.

In the year 1898 the woods were classified by me as follows :—

Description of Woods.	Woods over 80 years old. Acres.	Woods 40 to 80 years old. Acres.	Woods under 40 years old. Acres.	Total Acres.
Oak Timber Woods	380	14	33	427
Mixed Woods	190	741	364	1295
Simple Coppice Woods				667
Standels				449
The Endsleigh Pleasure Woods				35
Blank Areas				207
	570	755	397	3080

The oak timber woods are usually, though not always, situated near the banks of the rivers, and stretching for some distance up the slopes of the adjoining elevated ground. In many cases they are pure oak ; in others they contain a limited number of other trees, but not sufficient to class the areas as mixed woods. The density of the woods and the development of the oak differ much. In some cases the areas are fairly stocked and the trees show good dimensions ; in others the

crop is thin and the trees are short in the bole. Of the total area of 427 acres, 380 were stocked in 1898 with woods over 80 years old, showing that the establishment of young oak woods has been sadly neglected during the last two generations. Foresters seem, during that period, to have devoted their energies to the establishment of so-called mixed plantations, of which there were no less than 1,295 acres in 1898. These do not mark any progress in forestry, since we find mixed together on the same area as many species as it would hold—lightdemanding and shadebearing, quick growing and slow growing, spreading and conically shaped, tender and hardy species, hardwoods and conifers, have all been mixed together. Valuable hardwoods were introduced in too small numbers to form a wood by themselves, when the quicker growing conifers had become mature. Here then we find an utter neglect of the habits and requirements of the several species in mixture. The natural consequence was that the quick growing conifers, such as larch and Scotch pine, took the lead and, being unchecked by the hand of the forester, ousted the better kinds of hardwoods, and especially the oak. Hence, there are many plantations, where the trees, which were originally meant to serve as nurses for the hardwoods, have actually killed the latter, or crippled them to such an extent that they have become useless. "*The nurse has devoured the baby*"!

The simple coppice woods are mostly oak; they receive a cleaning, or thinning, at the age of 12 to 15 years, by cutting out the weaker shoots, as well as birch and furze, leaving the more vigorous shoots to grow for another 12 to 15 years, when they are cut over.

The "Standels" are oak coppice, in which one shoot has been left on each stool to grow up into a timber tree. This was, no doubt, a mistake, as, except under specially favourable conditions, the shoots of these old oak coppice stools have not produced decent sized trees. Even if they had done so, the lower part of the stem would be diseased by the time the trees are of sufficient size to yield fair sized timber.

INJURIES TO WHICH THE WOODS ARE SUBJECT.

Fires occur occasionally, and in one case, in Heathfield plantation, they ran over an area of 176 acres. They can be prevented

only by untiring watchfulness on the part of the woodmen, and by keeping the woods clean. Squirrels do much damage by barking Scotch pine and larch, generally 20 to 50 years old, at some distance from the top. They must be kept down. Arsenic works have done very considerable damage in the past. Most of them are no longer worked now, and in many cases the oak trees, which survived, have commenced to send out fresh shoots since the closure of the works. Rabbits are kept down, but not to a sufficient extent to do without wire-netting in the case of plantations.

Of Insects, *Tortrix buoliana*, the pine-shoot tortrix, has done some damage in Scotch pine plantations. *Chermes laricis*, the well known larch-aphis, has appeared, but not in excessive numbers. *Coccus fagi* has killed a beech tree here and there. *Armillarea mellea*, the honey fungus, has done much damage in plantations of Scotch and Weymouth pines, and also of Corsican pine, though in a less degree. *Peridermium pini* has appeared, but not to any great extent. The larch-blister was found in one wood in 1898. The diseased trees were cut out, and the disease has not spread up to date. It is, however, essential that in future larch be planted only in favourable localities, except where it is to act as a nurse, and when it will be cut out at an early age.

FUTURE TREATMENT OF THE WOODS.

When the future treatment of any woodlands has to be determined, the first step must be to ascertain the objects which the proprietor has in view. This done, it becomes the duty of the forester to realise them to the fullest extent, and in the most economic manner. In the present instance, it was not intended to use the woods as game coverts, but to let them serve the following purposes:—

- (1) To act, in certain cases, as ornaments in the landscape.
- (2) In other cases, to act as shelter-belts for farms and farmlands.
- (3) For the rest, in so far as the objects mentioned under (1) and (2) permit, to be managed on economic principles, the produce to be used partly for estate purposes, and the rest to be disposed of in the open market.

It was added that limited areas may be converted into fields

or fruit gardens, while certain fields might be added to the wooded area.

The objects indicated under (1) necessitate, in most cases, a deviation from economic treatment, more especially in the woods near Endsleigh Cottage. Still, even in these woods a fair return can be realized without interfering to any appreciable extent with their landscape beauty. The objects enumerated under (2) can in all cases be combined with economic treatment, just as in the case of the objects enumerated under (3). In these cases the financial aspect should always be kept in view. To realize the most profitable economic results, the woods should be managed for a sustained and approximately equal annual yield. On this depends the development of a regular demand for the produce. Moreover, these woods form part of a large estate belonging to one of the leading families of Britain, and it is essential that they should be so managed as to do justice not only to the present but also to future generations, so that they may provide for all time to come the timber necessary for estate purposes, and give a revenue commensurate with their area.

Bearing these matters in mind, the following lines of procedure were laid down for the first 20 years :—

- (1) To pay more attention than had been done during the last 80 years to the production of hardwoods, especially oak, by regenerating the existing oak woods for oak and other valuable hard woods, and increasing their area by adding suitable land, to be taken from coppice and mixed woods, as well as some fields in their vicinity.
- (2) To improve the mixed woods of the future by reducing the species in each to a reasonable number, only suitable species being associated with each other, and in such manner that they have a chance of thriving together. In all cases where conifers and hardwoods are mixed, the latter to be not less than 50 per cent. of the whole.
- (3) To convert the unremunerative coppice woods gradually into timber forests by introducing suitable species when the coppice is cut.
- (4) To cut out gradually the unpromising standels and to substitute seedling trees which are capable of producing valuable timber.

These proposals were sanctioned, and they have been acted on during the last 8 years.

TREATMENT OF THE OAK TIMBER AREAS.

It will be remembered that there were oak woods in 1898:—

Over 80 years old	...	...	...	380 acres
40 to 80	„	...	...	14 „
Under 40	„	...	...	33 „

Total ... 427 acres

Under the system of a sustained annual yield, not more than about 4 acres could be cut annually. As the bulk is over 80 years old, it was desirable to cut 10 acres a year, so that the existing old oak woods will last for about 40 years. After that period the necessary oak timber must, for a time, be found in the mixed woods until the young oak woods have grown up. At the outset, all the oak woods in the vicinity of Endsleigh Cottage would be spared, the 200 acres required during the first 20 years being taken from other woods, which I need not enumerate here. According to the original proposals, on the 10 acres to be taken in hand every year, all mature, badly shaped and diseased trees were to be cut, leaving only any young well-shaped and vigorous trees. This was altered afterwards, and the areas were clear cut. Whether this was wise, I am not prepared to say. Then it was proposed to sow the areas with acorns, or to plant oak seedling plants. The sowing of acorns did not succeed, because the acorns were destroyed by mice, so that planting was relied on. We have planted one-year-old seedlings, and also plants three and four years old. Some of the areas have been stocked with oak only, but on the greater part the oak were mixed with larch nurses, the latter being placed in alternate lines. The intention is to remove the larch when the oak require it. They will draw up the oak, and yield a large amount of small timber fit for estate purposes. As far as can be judged at present, this system is likely to give very good results. It is, however, essential that the larch should be cut out before it commences injuring the oak. Under this system we shall obtain pure oak woods at the age of 20 or 25 years, in which the oaks will then draw each other up. When they commence to thin out, they should be interplanted with beech, or perhaps with silver-fir.

TREATMENT OF THE EXISTING MIXED WOODS.

The areas were as follows in 1898:—

Over 80 years old	...	...	...	190 acres
40 to 80	"	...	...	741 "
Under 40	"	...	...	364 "

Total ... 1,295 acres

Adopting a rotation of 80 years, about 15 acres should be regenerated annually, or 300 acres during the first 20 years. The selection of the areas need not be given here. In all cases the cutting should commence in the east and proceed towards the west, so as to reduce damage by westerly gales to a minimum. The shape of the coupes should be that of strips running approximately north and south. Any parts of these areas, which are suitable for the purpose, should be re-stocked with oak, and in certain places with ash and sycamore, such parts being treated as indicated above for oak woods. The rest of the areas should be planted with larch in the better parts, especially in cool northern and eastern aspects, and Scotch, Corsican, or Weymouth pines on the warm southern and western aspects. The Douglas fir can be introduced in suitable localities, especially on those which are sheltered against western gales. The great point to aim at in all these cultural operations is to secure a full increment by establishing a full crop as quickly as possible. In that case straight tall stems will be produced, which will be free from side branches below. Later on thinning may be heavier, so as to add good girth to good height.

The middle-aged and young mixed woods must be gone over as rapidly as possible, so as to save any promising hardwood trees, especially oak and ash, which may be threatened by faster growing conifers. In this way a large number of oak and ash may be saved, which will become ready for cutting when the present old oak timber woods have been cut over.

TREATMENT OF SIMPLE COPPICE Woods.

These comprise an area of 667 acres. They will be cut over during the first 22 years, or at the rate of 30 acres a year, and converted into timber forests by planting suitable species between the stools, that is to say, larch, or perhaps ash or Douglas fir, in the better parts, especially on northern and eastern aspects, and

Scotch, Corsican and Weymouth pine on warm aspects. The fresh coppice stools have to be cut back when they outgrow the seedling plants until the latter are capable of holding their own. Suitable areas are being converted into oak timber woods.

TREATMENT OF THE STANDELS.

If these woods were situated at some distance from Endsleigh Cottage, they might have been treated in the same way as the simple coppice woods. As matters stood in 1898, they had to be dealt with very gradually, so as to convert them into timber forests. Still, the area should be dealt with in the first 20 years, or about 20 acres annually. Large clearances should be avoided, the cuttings to be distributed in groups over the area. When these have been re-stocked, further groups are taken in hand. Some of the standels are left standing on the area to act as a thin shelterwood over the plantation, until the latter can do without it, or to grow up with the new crop.

SUMMARY OF CUTTINGS PROPOSED ANNUALLY DURING THE FIRST TWENTY YEARS:—

Oak Timber Woods	...	...	10 acres	
Mixed Woods	...	...	15 "	25 acres
			—	
Simple Coppice	...	...	30 "	
Standels	...	...	20 "	50 acres
			—	
Total	...			75 acres

In addition, a large area of mixed woods should be thinned every year.

WORK DONE SINCE THE YEAR 1898.

Acting on the provisions of the working-plan indicated above, the work done during the last 8 years is shown in the following statement:—

	Timber Forest Acres.	Standels and Coppice Acres	Total Acres.
Area proposed to be dealt with in 8 years	200	400	600
Area actually cut in 8 years	200	336	536
Cut less than proposed	—	64	64

The cleared areas, as well as certain blanks, have been re-planted, some of the new woods consisting of one species only, others of two, and rarely of more.

The areas stocked with each species are as follows:—

Broadleaved Species.			Conifers.		
Oak ...	...	91 acres	Common Larch...	205	acres
Ash ...	...	16 "	Japanese "	...	4 "
Sycamore ...	...	6 "	Scotch Pine ...	125	"
Norway Maple ...	...	2 "	Weymouth Pine	32	"
Sweet Chestnut	...	6 "	Corsican "	55	"
Lime ...	...	2 "	Silver Fir ...	29	"
Beech ...	...	10 "	Douglas Fir ...	33	"
			Cedars...	...	4 "

Total ... 133 acres

Total ... 487 acres

Grand total of plantations in 8 years ... 620 acres

Average per year ... 77'5 "

Out of this area 13 acres were twice planted, the first planting having been destroyed partly by rabbits and partly by vigorous shoots from the former coppice. These failures amount to 2 per cent. of the total area planted. This must be considered a most satisfactory result. There are, no doubt, small failures in other plantations, chiefly due to the attacks of *Armillaria mellea* and *Tortrix buoliana*, but they occur only over limited areas, and can be filled up easily.

By the action so far taken, 620 acres of insufficiently stocked timber forests, coppice woods and waste-lands have been replaced by promising plantations, and if the system is continued, this forest estate will have become a very valuable one, capable of yielding a handsome revenue. The result is due to the enlightened views of the proprietor, and the indomitable energy and insight of Mr. Ed. Rundle, the Duke's Agent at Tavistock. Here we have an example of what can be done in the way of economic forestry, and it is to be hoped that the Royal English Arboricultural Society will some day find time to look once more at this remarkable piece of work. My own share in it is a humble one—I have merely systematised the local experience and views of the Agent on the spot—the credit for the work done is due to the latter and the foresters who worked under his orders.

OXFORD, 1st February, 1907.

W. SCHLICH.

TUBNEY ARBORETUM AND NURSERIES.

WHEN I came to Oxford in September, 1905, I wanted a site for the plants given to the Royal English Arboricultural Society by the Hon. Mark Rolle, which were intended to be the nucleus of an Arboretum to be established somewhere in the neighbourhood of Oxford, and were presented by the Society to the President and Fellows of Magdalen College. It was hoped that this Arboretum would be useful to forest students at the University, and also to other persons interested in forestry.

I considered that the soil of Bagley Wood was generally too stiff for the purpose, and that at Tubney, on land which was put at my disposal by Magdalen College, there could be found a site with sandy soil where the requisite conditions are more favourable for conifers than at Bagley, while its distance from Oxford, six miles, rendered the place easily accessible to cyclists. My old nurseryman, G. T. Bull, has come from Englefield Green to Tubney to work in the Arboretum and Nurseries, having been engaged, and housed there by Magdalen College.

A Joint Committee of the College and the Royal English Arboricultural Society was appointed to manage the Arboretum. This consists of G. E. Baker, H. J. Elwes, W. R. Fisher, A. D. Godley, G. Marshall, and Professor Vines. The Committee met at Magdalen College, Oxford, on the 16th November, 1906, and it is advisable that it should meet annually in November. Before this meeting Mr. Elwes and Mr. Marshall visited the arboretum. The Committee approved of the measures that have been taken. Mr. Baker was appointed Secretary, and he and Mr. Fisher were to carry out the work. It was pointed out that all the cost of the undertaking now falls on the College, and hopes were expressed that the Society would give a small grant towards the maintenance of the arboretum.

It has been objected that Tubney is too far from Oxford, and it is in fact twice as far as Bagley Wood, but the distance can be travelled by students on bicycles in about half-an-hour easily. Another objection raised is that the soil at Tubney is a poor sand above the hard coral rag, and that no striking results in tree growth can be obtained there. The answer to this objection is that the sand is four to eleven feet deep, and is kept moist by capillary attraction from sub-soil water held up

by the rock below. Oak grows fairly well in Tubney Wood on the right hand side of the road from Oxford, where the Arboretum is situated. The strong growth of bracken also shows that there is depth of soil and ground moisture sufficient for the growth of most trees. The excellent results obtained in the smaller nursery at Tubney this year, after an exceptionally dry summer, prove that the sub-soil remains moist under the most trying circumstances that are likely to occur.

It is also essential that experimental plantations should be made on all kinds of soil. The soil at Bagley Wood contains more clay, and is therefore more favourable for the growth of some trees than Tubney, but usually only poor land is available for planting in Britain, and good soil is retained for agriculture. The great advantage of experimenting with various species of trees at Tubney is therefore apparent.

For the Arboretum, five acres within the wood on the right hand side of the road from Oxford have been selected by Mr. Elwes, F.R.S., President of the Royal English Arboricultural Society, Mr. Baker, Bursar of Magdalen College, and myself, and carefully fenced. Plenty of shelter is available there, afforded by the oak standards and sycamore and other saplings, as well as temporarily by coppice shoots, which will gradually be cut away to make room for a plantation of groups of trees of various species. The epicormic branches of the oak standards have been pruned, and this benefits them, besides giving more light to the plantation. The bracken, which formed a dense undergrowth, has been cut, and next spring or early summer, when it begins to shoot up, it will be quite easy for the nurseryman to go over the area with a stick and break down all its young shoots.

Planting commenced in November, and has now been completed, the five acre plot being fully stocked. Each species forms a little group of twenty plants or less, according to the numbers available.

Each little group of plants has been labelled. Probably the most serviceable labels will be split oak laths, about four inches wide and four feet long, the lower end pointed to go into the ground, and the upper end planed on one side to receive the name of the plants. These should be written on the laths with a woodman's indelible pencil. The present labels are of spruce,

painted white, oak laths not having been available. Besides the plants now in the nursery, members of the Royal English Arboricultural Society have promised to supply other specimens that may be required, and already several thousand plants have been so given by Mr. Elwes, Sir Hugh Beevor, Mr. Fotheringham (President of the Royal Scottish Arboricultural Society), Professor Somerville, and Mr. Herd.

A number of seeds of hardy species of *Eucalyptus* were presented by Mr. Eales, Commissioner of Pegu, having been received by him from the Forestry Department, West Australia. They are being germinated at the Oxford Botanic Gardens. Mr. A. Smythies has also sent seed of *Pinus Gerardiana* and of *Deodar*.

The five acres already fenced in have now been stocked, and next autumn the fence can be removed further down, and a similar area enclosed and planted. In this way, the College woodland north of the roadway will be gradually underplanted, to the great benefit of the now existing standard oaks, which have remained too long isolated. It is hoped that thus a most interesting arboretum will be established, and it will soon be ascertained what species of trees do best on the sandy soil of the neighbourhood. Already about 200 species of conifers and broadleaved species have been planted, beech plants being introduced to keep down weeds and to shelter the ground.

In order to supply this arboretum with plants, and also to supply plants for the derelict farmlands on the College property, two nurseries have been established. The smaller nursery, known as "Cowpen," is close to the arboretum, on the left hand side of the road from Oxford. It is about one acre in area and is situated on sandy soil similar to that of the arboretum. Although during the present exceedingly dry summer the soil has proved moist enough for both transplants and seedlings, it has been found necessary to sink a well close to the nursery, and connect it by means of a pipe and pump with a zinc tank within the nursery. This tank will be filled by the nurseryman every night during dry weather in the spring and autumn, and seed beds only, not the lines of transplants, will be watered on the following afternoon. The transplants require no water in the driest season, as the condition of the 40,000 larch plants lined out last spring when only one year old, and of the other transplants lined out in the nursery, proves in the most striking manner.

These larch plants, now only eighteen months old, have already been transplanted into the new College plantations. Seedlings from seed sown last spring have also proved successful. There are splendid beds of Douglas fir, sessile oak, *Picea Omorika*, *Prunus serotina*, and Corsican pine, but these seedlings, at least the coniferous ones, had they been watered would have been stronger still. One thousand *Tsuga mertensiana* plants, presented by Mr. Fotheringham have also been lined out, and one thousand *Thuja plicata* plants given by him are now being lined out, as are also the seeding Douglas firs. Owing to the excellent results obtained from sowings in this nursery, it is proposed in future to do all the sowing there, and also to line out small lots of the more delicate plants in it.

The larger nursery, which I will now proceed to describe, will be used exclusively for transplants. This nursery, known as "Blackwater," contains 5 acres, and is about half-a-mile from Cowpen, and close to the nurseryman's cottage. It has been fenced round with wire-netting and a beech hedge, Cowpen being similarly fenced. At present, most of the area has been used for growing potatoes or oats, in order to clear the soil of weeds, and to ensure its thorough cultivation. It would have been better had the rest of the area also been thoroughly cultivated before lining out plants in it. In future, no plants will be lined out in the Blackwater nursery until the land on which they are to be placed is thoroughly trenched. There is a natural well in this nursery with an ample supply of water.

In all nurseries, especially when situated on poor sandy soil, manuring is necessary, and experience gained at Coopers Hill has proved that basic slag and nitrate of soda form the best manures for conifers. For broadleaved trees ordinary old farm-yard manure is suitable. The best way to apply the chemical manure is to sow the basic slag in the autumn between the rows of plants, it is then gradually washed down to their roots. Nitrate of soda is similarly sown in spring between the rows. Some nurserymen use kainit as well as basic slag and nitrate of soda, and experience will show if this is necessary at Tubney.

Blackwater nursery contains several thousand beech plants that will remain for another year in situ. There are also some Corsican pine plants that have been re-lined out.

A complete list of the plants now in the arboretum would

take up too much space here ; but this list is carefully kept up, and will be printed for distribution to members of the Society.

W. R. FISHER.

OBSERVATIONS ON THE EFFECTS OF SPRING AND AUTUMN FROSTS IN 1905-1906.

THOUGH many observations on the effects of severe winter frosts on trees and shrubs have been recorded in various horticultural publications, the effects of late spring and early autumn frost, though perhaps more injurious to vegetation, seem to have received less notice from writers on forestry. Dr. Somerville's report on the effect of frost on trees and shrubs, published by our Society in 1895-6, is the last important paper on this subject.

As my own experience has been singularly unfortunate, I thought that the following notes might serve as a warning to those who wish to raise and plant trees in localities which are liable to such frosts.

I may say that Colesborne, Glos., where these observations were made, is at an elevation of about 500 feet in the Cotswold hills, and lies in a sheltered valley of the Churn where spring frosts seem to occur later in the year than in almost any place I know. July and August are the only months which are free from night frosts near the bottom of the valley, whilst the exposed hills around are much less subject to them.

I was absent from home during the latter part of May, 1905, and therefore cannot personally guarantee the exact temperatures registered, but am assured by my forester and gardener that on the night of May 21-22 the thermometer in the walled garden descended to 24°, and in the place where my experimental plots are situated as low as 20° was registered. This frost was accompanied by a north wind, which made its effect more severe than usual. And to make matters worse, at the end of October, when the growth of most of the trees was still active, another severe frost occurred when the thermometer registered as low as 12° to 14°. The effect of the two frosts was not in many cases really evident until the late spring of 1906, when a period of dry cold wind with frost on almost every night in the month of April completed the destruction of many young trees which might have otherwise

recovered, or left them in so crippled a condition that it is very doubtful whether they will ever make shapely trees.

Æsculus hippocastanum. (Horse-chestnut).

In low situations, much cut, and the leaf stalks never recovered their normal straightness where bent in the middle by the effect of the frost. Seedlings, however, in the nursery are practically uninjured. Other species of *Æsculus* such as *rubicunda*, *indica*, and *octandra* (*flava*), do not seem to have suffered so much, probably because they are later, and in a more sheltered position.

Acer macrophyllum.

Young trees had their young wood killed by the severe frosts of November, and were again cut back on May 21st, though the tree is hardy in Yorkshire when old enough and tall enough to ripen its wood.

Acer campestre.

Quite uninjured.

Acer dasycarpum.

Uninjured.

Acer insignis.

Uninjured.

Acer Negundo.

Uninjured.

Acer opulifolium.

Uninjured.

The same remarks apply to these as to the other species of *Æsculus*.

Acer platanoides, and var. *Schwedleri*.

Quite uninjured.

Acer Pseudoplatanus. (Sycamore).

Though I look upon this tree as one of the hardiest of British hardwoods, and though the seedlings are uninjured, so far as their cotyledons are concerned, yet the young foliage was a good deal browned where exposed to the wind.

Acer Trantvetteri.

Owing to its late leafage, quite uninjured, though in a very exposed situation.

Acer pictum.

Uninjured.

Acer lobeli.

Not injured.

Ailanthus.

The young wood of young trees killed back in autumn for 2 or 3 feet, and the young growth badly frozen in spring, though older trees did not shew anything like the same amount of damage.

Alnus glutinosa and *incana*.

Quite uninjured.

Arbutus Unedo and *Andrachne*.

Not sufficiently advanced to be seriously injured.

Betula alba (both forms) and *B. papyracea*.

Hardly touched.

Betula Maximowitzi.

Slightly injured.

Carya. (*Hicoria*, Sargent). Several species of hickory.

Too late in leafing to have suffered much in spring, but the wood was killed back to the ground in the case of seedlings.

Carpinus Betulus. (Hornbeam).

Uninjured.

Castanea sativa. (Sweet chestnut).

Slightly cut, but too late in leafing to suffer much.

Cercidiphyllum japonicum.

Though perfectly hardy as regards winter cold is very tender in spring, and has had the young shoots frozen every year.

Corylus Colurna. (A tree from S.E. Europe, Asia and Himalayas).

Uninjured.

Fagus sylvatica.

No native tree has suffered more severely than the beech, especially small nursery plants, which had not been transplanted. The check which they received is so severe that on the 7th July many of them had only just begun to put forth new leaves, and as these are suffering from *aphides* and sun-burn, a great many will either die or be so crippled as to be worthless for planting. Freshly transplanted two-year seedlings, being later, have not suffered so much; but old trees, wherever exposed to the wind, have had their leaves frozen up to 20 and even 30 feet from the ground. I can see no difference in the hardiness of beech raised from Scotch, German or English seed, or even in those brought from the south of Italy. Notwithstanding the effects of the frost there is a greater quantity of beech mast, much of it however empty, on the trees than in any year that I remember, except

1900; shewing that the flowers will resist a much greater degree of cold than the foliage.

Fraxinus.

All kinds of ash, with two or three exceptions, which come very late into leaf, have been very badly frozen, and in low situations, where the young trees are not very vigorous, a great many branches will die entirely. The young ash, however, which are more vigorous, are throwing out new shoots much better than the beech, though the shape of the tree will be permanently injured. The ash which suffered least in the nursery were self-sown seedlings taken out of plantations in the previous winter which were much more backward. Most of the ash seed, having been purposely sown late, had not germinated, and has not suffered so much as in some previous years.

Gleditschia triacanthos.

Too late in leafing to suffer any injury.

Gymnocladus canadensis.

Too late in leafing to suffer any injury.

Juglans cinerea, nigra, and regia.

The two American walnuts are undoubtedly harder both as regards spring and autumn frosts than the common species, though all three were badly frozen this year. It seems almost impossible to raise straight-stemmed standard walnuts in ordinary situations here, except in sheltered and elevated situations; but the existence of many fine walnuts in the district seems to shew that spring frosts were not so bad formerly as they are now.

Liriodendron Tulipifera.

Though the leafage of the tulip tree in its young stage seems extremely tender, it can resist frost better than many exotic trees, and, though difficult to transplant when it has attained any size, should certainly be planted more generally than it is at present.

Morus nigra. (Mulberry).

Too late in leafing to be much injured in spring, but all the young wood killed in autumn.

Platanus acerifolia and orientalis.

Of these two, the London Plane seems to be distinctly the harder as regards its spring foliage, but neither of them can resist such frosts as this, and cold winds are almost as bad in

their effects as frosts. A tree which I brought from Asia Minor 30 years ago, and planted in a low situation, has had its wood so repeatedly frozen in autumn that it remains a large bush; and the only seedling which I have raised, though in a sheltered situation, was killed nearly to the ground.

Platanus occidentalis.

If this exists at all in this country as a tree, which I much doubt, it is much more tender than either of the eastern planes, all those which I have planted having been killed previous to this winter.

Prunus Avium.

The wild cherry seems to be one of the hardiest trees we have, and is not the least injured, even in low and damp situations.

Prunus serotina.

Though not likely to grow to a timber tree in this country, except in favoured localities, this is very hardy as regards spring frosts, and has not been much injured.

Prunus Padus. (Hagberry).

Quite untouched.

Pterocarya caucasica.

Though it has attained a considerable size as far north as Cambridge, no tree suffers more both from autumn and spring frosts, but the Chinese *Pterocarya*, though too small to judge of at present, is distinctly hardier than *caucasica*.

Pyrus domestica. (Service tree).

Though a difficult tree to raise and transplant, seems hardy as regards spring frost, and is uninjured.

Pyrus Torminalis. (Wild service tree).

P. Aria. (White beam).

P. Aucuparia. (Mountain ash, Rowan).

All quite unhurt.

Populus.

The species of poplar, except perhaps the Lombardy, seem to resist spring frosts better than most trees, and may be planted with impunity in the lowest and dampest situations.

Quercus.

The oak leaves were frozen in all low situations, to a height of 20 or 30 feet from the ground in some cases, yet they seem to suffer less from the effects than ash or beech. I cannot see any appreciable difference in the spring-hardiness of any of the

numerous forms of *Q. pedunculata* and *sessiliflora* which I have raised from seed. Turkey and Lucombe oaks suffered more than the common one. All the evergreen oaks, such as *Ilex*, *Suber*, etc., though hardy as regards winter frost are tender in spring, and young plants of both in some cases are killed. The American oaks being more newly planted and not so vigorous seem to have suffered less than the European ones. Seedlings of a variety of pedunculate oak called *tardissima*, which has been specially recommended by French foresters for situations liable to late frosts are only touched in a few instances, but it is too soon to say whether the late growing habit will prove permanent in this country. *Q. castaneaeifolia* from the Caucasus and *Q. serrata* from China and Assam seem quite as hardy as our common oak.

Robinia Pseudacacia.

The Common Robinia had its young wood killed in autumn, and the shoots again in spring, but has sprouted vigorously.

Sophora Japonica.

Too late in leafing to suffer.

Tilia argentea.

T. petiolaris.

T. platyphyllos.

T. parvifolia.

T. vulgaris.

T. Americana.

I cannot see much difference in the apparent hardiness of any of the limes. The foliage of all seedlings suffered, but not nearly so much as that of beech and ash. Large trees do not seem to be injured at all.

Ulmus campestris.

U. glabra.

U. montana.

Next to the poplars the young foliage of elms seems hardier than that of any other deciduous trees, and though in exposed situations the seed of the Wych Elm was destroyed, yet in low-lying sheltered places I was able to gather ripe seed which has germinated.

Zelkova Keaki.

Z. crenata.

These two beautiful trees, though little known to most foresters, and liable to have their young wood killed back by autumn frosts, resist spring frosts better than many trees.

CONIFERS.

Abies.

Of many species of Silver Fir which I have planted the ones which resist spring frosts the best are *balsamea*, *concolor*, *Nordmanniana*, and *Pinsapo*; but even of these the two latter in low lying situations had their buds killed. *A. concolor*, however, even in quite small seedlings, is quite untouched, while the Common Silver Fir in a more sheltered situation was very badly frozen, and most of the American and Himalayan species were injured or killed. Of the Japanese species, *A. brachyphylla* is the only one able to grow on my soil, but young trees of this have lost the young side shoots, though the terminal bud, being later, was not injured.

Araucaria imbricata.

Though liable here to die in severe winters, is very hardy as regards spring frosts, and small seedlings raised from English trees are hardly injured.

Cedrus.

Of the three cedars I should say that *Libani* was the most hardy, some young specimens of *atlantica* having their young shoots browned, while *Deodara* in low lying situations is considerably injured.

Cryptomeria Japonica.

Some young trees recently planted in a low situation were killed, I believe by the frost of October; but some raised from Hampshire seed have proved perfectly hardy, and though the young growing tips were browned in spring, the tree is evidently hardier than many conifers which are much more largely planted.

Chamaecyparis Lawsoniana.

Much browned in low damp situations, but not seriously injured.

Chamaecyparis Nootkatensis.

Absolutely uninjured at any age or in any situation, and one of the best trees I know for planting on poor land in exposed places.

Cupressus macrocarpa.

Some of my largest home-raised seedlings were killed, as I think, by the autumn frost, but others remain uninjured, whilst a number of two-year-old seedlings pricked out of a box into the open ground early in May have remained, with some exceptions, almost unhurt. These were raised from foreign seed, but I believe that this tree if raised from seed grown in the colder parts of England will resist any but extreme frost with impunity, even when young.

Cupressus torulosa.

Though my tree is in a sheltered situation it seems quite as hardy as a deodar, and much hardier than the Himalayan silver-firs, and remains uninjured.

*Juniperus communis.**J. Chinensis.**J. recurva.**J. Virginiana.* (Pencil cedar).

None of these seem to be much hurt, though the young shoots of *communis* are browned, and *Virginiana* is certainly easier to transplant and as hardy as the common species.

*Larix Americana.**L. Europæa.**L. danurica.**L. Leptolepsis.**L. occidentalis.**L. Sibirica.*

The effect of the spring frosts on the larches generally has been very marked. *Sibirica* has suffered the worst; *Leptolepsis* is certainly more tender in spring than the common larch, but what is most remarkable is the difference in the individuals in this respect, their resistance to frost seeming to depend on their vigour. Newly-transplanted one-year seedlings have suffered less than older trees which had not been transplanted. In some situations the less healthy trees are so severely injured that I do not expect them to recover, whereas some very vigorous trees grown from the same seed and treated in the same way do not show a trace of injury. It is evident to me, after many years observation, that the selection of seed from the most vigorous trees which experience proves resist spring frosts the best, is the way by which we can best hope to restore to our

larch plantations, except under the most favourable conditions, the health and vigour which they had many years ago. The only one of the larches which seems absolutely proof against spring frost is the American larch, and I believe that it might be crossed with the common larch with very good results.

Picea.

The same individual variability in the hardness of young trees which I have noticed in larch is equally conspicuous in the common spruce. In a bed of about 20,000 seedlings there were about 15 per cent. badly frozen, a similar number were so late in growing that they were quite untouched, and the remainder suffered in a variable degree according to the extent to which they had started their spring growth. The earliest and latest of these trees I have marked for future observation. Of the American spruces I should say that *Engelmanni*, *Sitchensis*, and *nigra*, are all equally hardy, and harder than a good many of the Norway spruce. Of the Japanese species, *Hondoensis* (usually known as *Ajanensis* or *Alcockiana*) is equally so, but the Himalayan spruce is in some cases almost killed. Two species from Eastern Europe, namely, *orientalis* and *Omorica* are both, owing to their late leafing, absolutely spring-hardy, and the latter grows faster on my soil than any other spruce I have raised.

Pinus.

None of the common pines have suffered in the least, but *insignis* and *Pinaster* were both injured in autumn. *Ayacahuite* and *ponderosa* both seem quite hardy.

Pseudotsuga Douglasi. (*Mucronata*, Sargent).

The opinion which has been expressed by some writers, whose experience seems to be gained particularly in Germany that the so-called Colorado variety of this tree is harder than the Oregon one, is quite disproved by my experience. Many individuals of both varieties were badly injured in May, whilst others, pushing their young growth later, were uninjured. I have no hesitation in saying that the best means of propagating this tree for economic planting in England is to raise it from trees, preferably grown in Great Britain, which are known to be vigorous and hardy, but if not, from seed gathered in the mountains of British Columbia.

Sequoia gigantea.

S. sempervirens. (Californian redwood).

Of the two sequoias *gigantea* is undoubtedly the hardier, both as regards spring and autumn frosts, and though the foliage is slightly browned in some cases, yet most of my trees in the most frosty situations are uninjured. *Sempervirens*, however, is much more tender as regards its young growth and in some cases was killed to the ground.

Taxodium distichum. (Bald cypress).

Though this tree is perfectly hardy when once established in the warm parts of England and is able to resist almost any amount of winter frost, yet in the low and damp situations which it naturally prefers, it suffers very much from frost both in autumn and spring. Most of my young plants are so much crippled that I doubt whether they will recover.

Taxus baccata.

Though the yew is supposed to be one of our hardiest trees, yet small seedlings were much browned and injured.

Torreya myristica.

At least as hardy as the common yew so far as I have observed.

Thuya plicata (known as *Lobbii* or *gigantea*).

Few trees have come through the ordeal better than this. Great numbers of young trees in the most frosty situations I can find are unhurt, though their growth was severely checked, and the exceptions seem to have suffered from the cold winds and hot sun which accompanied it, rather than from frost itself. Many small seedlings newly transplanted, though their growth was checked, have now started well and are making good leaders, and I have little hesitation in saying that this tree may be planted successfully in low and damp situations where no other conifer of equal value will thrive in this district.

Thuopsis dolabrata.

This beautiful tree, though a slow grower, loving a damp climate and heavy shade, seems absolutely hardy both as regards autumn and spring frosts.

Tsuga canadensis. (Hemlock).

Perfectly hardy, but will not grow on my soil.

T. Hookeriana.

Though an Alpine tree, able to endure the severest winter frosts, it suffered a good deal in the spring.

T. Albertiana. (*Mertensiana*, Sargent, Mountain hemlock).

This hemlock seems to endure spring frosts very fairly, and is little injured; but on my soil does not grow at all well.

Libocedrus decurrens. (Incense cedar).

Quite uninjured, and seems to grow as well here on heavy soil as any Californian conifer.

H. J. ELWES.

P.S.—I wish to qualify my statement as regards the hardiness of *Thuya plicata* freshly planted on heavy soil in low-lying situations; as though not killed at the time, some of them have never got over the effects of 1905. It also seems to me, after observing the effect of the same season in other places, that drainage, aspect, and the comparative want of vigour that many young conifers show on my soil, are important factors in determining their ability to resist frost.

DEODAR IN THE HIMALAYAS.

DURING the recent tour of the Royal English Arboricultural Society in Devonshire, a good deal of discussion took place and enquiries were made regarding the conditions of growth of the *Cedrus Deodara* in its native habitat in the Himalayas, and as I was in charge of extensive forests of that species for about 20 years, a few personal notes may be of interest to the readers of the *Journal of Forestry*.

In the Himalayan belt of the United Province of India, formerly called the N. W. Province, and also in the Punjab, deodar is found growing at altitudes varying from 4,000 to 9,000 feet, this species being found naturally lower down towards the North and higher up towards the South. It flourishes best on gneiss and granite soils, but fine forests are also found growing on limestone formations, as in the case of the forests of the Jaunsar Division of the United Provinces. In all cases it prefers a well-drained soil, and the largest trees are generally found growing on the terraces of old abandoned fields, which often occur in the forests of the Himalayas, and which give unmistakeable evidence

of the former troubles of the country from the effects of wars, plague and famine in the olden time, when these forests grew up during the absence of the usual population. In these forests, the deodar often covers extensive areas, and one forest of which I held charge comprised an area of about 20,000 acres of pure and mixed deodar. In the forests referred to, deodar is sometimes found growing pure, but as a rule it is mixed in varying proportions with *Pinus excelsa* (Blue pine), *Abies Pindrow*, and the three commonest N.W. Himalayan oaks, *Quercus incana*, *Q. dilatata* and *Q. semecarpifolia*. As a rule, pure deodar forests are found growing at the lower altitudes, and it should be noted that generally these forests do not look so healthy or produce such good timber as the forests situated higher up, and where it is generally mixed with the species above mentioned. When found pure the trees often have a stunted appearance, are sometimes covered with moss, and the foliage is of a light green tinge, whereas when it grows mixed with the other species, and especially with the evergreen Himalayan oaks, the trees are much more vigorous.

In the mixed forests the young seedlings also have a bluish green colour, with vigorous drooping branchlets, including the main shoot, which in healthy trees always bends over and continues to do so till the trees are about 15 feet high. As regards the seedling of the deodar there is generally a profuse crop once in three or four years, the seedlings during the intervening years being very partial or altogether a failure.

The male catkins appear in September and shed a profuse shower of yellow pollen in October, at which time the female flowers are extremely small and consequently very difficult to find.

The young cones develop rapidly during the spring and summer, and especially during the rain of July and August, and ripen in October and November.

In favourable localities, *i.e.*, where the soil is not too thickly covered with grass and undergrowth, or where it is not too damp, and especially where the turf has been broken up by the feet of cattle, the seeding is generally followed during the following spring by a splendid crop of young seedlings, and which often extend to fifty yards from the parent tree.

Owing to the amount of oil the seed contains it keeps badly, so that the plan is always followed of sowing it during November in the nurseries, or on prepared patches, or in lines in the forests.

As regards the treatment of the seedlings in the nurseries, they are generally twice transplanted, and finally planted out when they are $2\frac{1}{2}$ years old, by which time they have attained a height of 12 feet 15 inches, with well developed roots, etc.

For use in special cases the plan is employed of planting young seedlings in small bamboo baskets, 9 inches by 3 inches, and when the plants are about 15 inches high they are planted out together with the baskets, which soon rot, and by this arrangement the roots remain undisturbed, and the failures are reduced to a minimum.

Regarding the dimensions and rate of growth of deodar in the Himalayas, under special conditions it attains in 70 or 80 years about 90 feet in height, with a circumference at three feet from the ground of 5 to 6 feet, when it is considered fit for felling; as a rule however, the rotation or age of felling of the deodar forest is fixed in working-plans at about 120 years, which ensures an average girth of 8 or 10 feet.

In some parts of the Himalayas, the deodar, under favourable circumstances, attains very large dimensions, and Sir Dictrich Brandis, late Inspector General of Forestry, in his "Flora of Northern India," mentions a tree of 20 feet in girth, and 250 feet high, measured by him in the Valley of the Sutlej, and the late Dr. Stewart mentions another having 36 feet in circumference, in the same locality. These trees, however, must be looked upon as exceptionally large, and the tallest tree observed in any of the forests of which I held charge measured 216 feet high, with a girth of 12 feet, though many trees of 12 to 15 feet girth were felled, having an average height of about 120 feet.

In the deodar forests, and especially near villages, trees are often found with several stems instead of one single leader. This is due to the damage done to young trees and even large ones by the axes of the villagers, who often lop them severely for fuel and bedding for their cattle. So great, however, is the power of reproduction of this species, that if a few branches only are left, even on a mere stump, these soon straighten up and form a clump of main shoots like a coppiced and pollarded tree.

Deodar in the Himalayas is sometimes subject to the attack of a kind of fungus believed to be *Pomes annosus*, the characteristic feature of which is that it produces *rhizomorphs* and attacks principally saplings and young trees up to about 50 years of age. Young trees and saplings also suffer frequently from the attack of black bears, which during the early spring when the sap is ascending, strip off the bark, which at that season is apparently much appreciated by them.

E. Mc.A. MOIR.

THE HOME TIMBER TRADE.

AS was remarked in the first number of this Journal, it is very probable that we have touched bottom prices in most kinds of British timber. For same time the cost of many foreign timbers has been going up, owing partly to the comparative exhaustion of available supplies, and partly to the increased and increasing requirements of the exporting countries themselves. Of course we are not prepared in this country as yet, nor at the present rate of planting are we likely for some time to be able, to supply our own wants in the direction from which the largest demand comes, that is, for building timbers, pit-props, and railway sleepers. A start has been made in improved forestry; but the matter has as yet only *begun* to take practical shape. There can be no possible doubt that the present-day planters, or their successors, will reap a good harvest as their crops mature, when we remember how the supplies from foreign sources have depleted growing stocks there.

The demand for native timber of good qualities has kept up, and perhaps increased, during the past twelve months, in most species of timber trees. It is rather a sad fact that in some districts there has been a change for the worse in the demand for larch. Some collieries, which up to a year or two ago were in the habit of using enormous quantities of larch, have suddenly begun to use imported timber in place of it, with the consequence that many merchants have large stocks that are almost unsaleable. It is a fact that this change has brought down the price some pence per foot, and this loss falls upon

the grower eventually, because the handling charges remain the same, and are on many kinds of timber quite as much as, and in other cases more than, the value of the timber on the ground. When will timber growers realize how their crops are handicapped in the market by railway rates? Of course, this drop in the value of larch is not general over the country. Local demand is an important factor in the fixing of timber prices, and prices ruling in one district are not at all necessarily any criterion as to what they ought to be in another. Again, it is very misleading to quote the high prices which are sometimes realized for single special trees, as though they were standard average rates. It is easy to understand that, say, in a district where agricultural implements are largely made, a few prime ash trees will command even fancy prices, especially if a bit of fever can be worked into the blood of the buyers for rival firms. The first cost of the raw material for the quantity of ash which is used in a costly implement is not much in comparison with the total value of the finished machine, and an extra shilling, or even two shillings, per cubic foot is comparatively unnoticeable; but it is a different matter if this be taken as a fair criterion of average values. First-class ash has been worth from 1s. to 1s. 6d. per cubic foot on the ground, according to the grade of quality and cost of transport.

Good oak keeps up fairly well. Now that the supply of American oak for car building is mostly wanted in the States, there ought to be a better sale for home-grown timber of suitable sizes; especially when its superior lasting qualities are taken into consideration. Medium sized oak, if of good quality, is also quite as much in demand as ever it was. Low grades are difficult to dispose of, and for small poles there are not many openings, and they have to be sold for as little as 6d. per cubic foot on the ground. Seasoned English oak planks and boards ought to command a better price than they have done for years, owing to the present exceptional demand for architectural purposes.

In the south, the better prospects in tin mining should improve the demand for elm for boxes for packing. There is no better demand for elm in the northern shires, 7d. per foot is about its price in the woods there.

Beech has been in good demand for some time, especially if clean and hard-grown. But the price, 6d. to 8d. per cubic foot does not look very remunerative, unless dense crops have been grown. With crops like those on the continent, it would prove better worth-while growing. Unfortunately, the quality of the closely grown German beech is not such as to make it easily saleable here. It is too soft for most purposes. Sycamore of large sizes (cut off at 20 inches diameter) is good to sell at remunerative prices; medium sizes are not so valuable by far as they were some years ago, before the extensive import of maple blocks for washing-machine rollers began. Small sycamore, up to 11 or 12 inches quarter-girth, is only saleable for bobbin-wood now, and is worth the same price as beech. Clean alder and birch are in fair demand at 4d. to 6d. per cubic foot in the plantation; but the latter price is not easy to obtain.

Scots pine, when of large size and hearty, is not difficult to sell at 3d. or 4d. per cubic foot in the wood, but the smaller sizes, as well as spruce, have to compete with foreign timber—which is delivered at the pit-head at 8d. and $8\frac{1}{2}$ d. per cubic foot.

It is found for pit-wood purposes, once the colliers in any pit have the handling of foreign pit-timbers, that the managers seldom change back to English-grown, because the former is so much pleasanter to handle, owing to its comparative freedom from roughness and knots. However, "there is a good time coming" if foresters will learn by experience and observation, and prepare crops which are suited to the market, instead of blindly going on expecting the user to take anything the grower may offer, and we shall presently have more crops of timber placed on the market which will be fit to compete with foreign rivals.

NOTES FROM DERBYSHIRE.

IN this part of the country, where big shoots are the rage, there is very little to chronicle of any importance in forestry matters, seeing that on almost every estate in the neighbourhood woods and coverts have to be kept quiet from

the end of September to the beginning of February, and if a woodman dare to trespass therein he is looked upon as committing a sacrilege. This order of things hampers the forester considerably, inasmuch as he has not only to cram the work of six months of what should be the busiest portion of his year into as many weeks, because, not only by that time must the woods be kept quiet for pheasant laying, but the (for him) all too limited time for planting will have expired; and it is better to let stand over till another year any portion of this work that is then uncompleted, than court failure by planting too late in the season. It makes one not a little envious, too, to know that other foresters, who have the happiness of living on estates where game is not preserved to any large extent, were able to complete their planting before the advent of the new year, and are now well advanced with other portions of the work. When, added to the above disadvantages, one has to face a season like the present, for we have been under Arctic conditions consisting of severe frost and snow since the third week in January, with, as yet, no signs of any improvement (this is being penned at the middle of February), it looks like being an impossibility to carry out the necessary and imperative planting operations and nursery work, to say nothing of erecting and repairing fences, brushing and thinning of woods, as well as the hundred and one other duties a forester has to undertake during the busy spring months. Planting, so far, has been out of the question, and the only outdoor wood-work possible has been timber felling. We, in this neighbourhood, do not believe in selling timber standing, as we think it pays better for the estate woodmen to fell and dress the timber before it is offered for sale. Hence, it is yet too early to look for much of this being put on the market; but, from enquiries, and from the few lots that have changed hands, there is every reason to look for prices of most classes of timber having an upward tendency.

The demand for oak, ash, larch, and sycamore of good size, seems to exceed the supply, while good beech and elm are also in request. Prices rule as under:—

Larch, good size and quality	1/- to 1½ per ft.
Oak, fair trees, 30 feet average	1/4 to 1/6 „
Ash do. 20 to 30 feet average... ..	1/4 to 1/6 „
Elm, according to quality	8d. to 10d. „
Sycamore, of good size, according to quality	1/- upwards
Beech, first size and quality	10d. to 1/- per ft.
Do. second size and quality	8d. to 10d. „
Scots Fir	6d. „
Spruce	6d. „

These prices are for timber measured by tape over bark, and include all limbs and tops down to 5 in. quarter-girth. Timber easy of access, close to a good road, and within reasonable distance of a railway station.

There is no underwood of any consequence in this neighbourhood, all being under the high forest system. Where rabbits and hares are preserved, much damage has been done to young plantations during the recent severe weather. Wire-netting, unless of great height, is almost useless against the latter of these pests; and, indeed, there seem to be so many mysterious ways by which hares, and especially rabbits, gain entrance, that although netting may to some extent check their ravages, it is not in any way to be relied upon as a sufficient protection for the proper rearing of young plantations. The only effective means is extermination, and it is doubtful whether the gamekeeper can be depended on to do this. Nor, in some cases, is he altogether to be blamed. Where, nowadays, such quantities of pheasants have to be hand-reared and carefully looked after all through the season, his hands are fairly full, except for a week or two in the early spring, and during that short period he has to see that his pheasantries are erected and in good order, trap and clear out vermin, and attend to his other multitudinous duties; and if there should be a goodly number of rabbits by shooting time, well! they are all fish that comes to his net, especially as he is expected to produce as good a bag as he had the previous year, and, if possible, to exceed it. Yet I have heard, on the gamekeeper's own word, of an estate (pleased to say it is not in this immediate neighbourhood) where this shooting season over 20,000 rabbits were killed, and on this estate woods are supposed to be on an improving grade. Is it possible for an owner of

woodlands, or agent, to understand the heart-break and worry of a forester, who, after giving the best years of his life trying to put the woods and plantations under his charge on a proper basis for profitable timber growing, finds his best efforts unavailing, as his young plantations are ravaged year by year by rabbits and hares? His main crop of hardwoods—his mainstay—and often part of the nurses as well) are eaten down season after season, and are replaced only to suffer a like fate.

Each year the plantation loses value by irregularity of growth and timber depreciation. Thus the original cost of establishing a plantation may be more than trebled, and if this excess expenditure is charged to woods, as it generally is, and not to game, as it ought to be, it is only one more worry for the forester, and one less for the gamekeeper. Added to this, too, is the fact that there is all the difference in the final crop between a wood's profit and bankruptcy. Has it ever occurred to our woodland owners and agents on estates, where game is preserved, to have the resultant damage and depreciation of crop valued annually and tabulated in £ s. d.? Notwithstanding that every writer on forestry has drawn attention to the subject, from observation up and down the country, I fear not; and think that, were they to do so, the result would be surprising. Far be it from me to rail at any one's love of sport. The writer believes that every forester with which he is acquainted would do his utmost to encourage all winged game, and would be more than pleased to see his woods turn out every bird they can hold; but he has a shrewd suspicion that, although many causes have been given as to the lack of advancement of forestry in Britain, the havoc by ground game is possibly the greatest of all.

Some few estates there are even now whose owners are alive to the fact, but on most, the excessive cost of establishing, together with the poor results obtained, are not encouraging; and until we are able to give ocular demonstration of economic success, Britain will never take her place among the timber-producing nations of the world.

JAMES P. ROBERTSON.

OLD OAKS IN WENTWORTH PARK,
YORKSHIRE.

THE Brown Oak, in the accompanying photograph, was felled (as it was dead) in Shire Oaks Wood, close to Wentworth deer park. It is difficult to estimate the age of this tree, or other large trees in the park, but I should imagine about 300 years. The soil is chiefly clay, on a strong clay sub-soil, resting on sandstone. It is supposed that these oaks are the remnants of the old natural forest extending from Sherwood Forest, in Nottinghamshire, to this part of South Yorkshire. It is a great pity to see these grand old trees, many with three to four hundred cubic feet, dying off one by one, and now that they are standing so exposed, and so thin on the ground, they are going even faster. Wentworth Woodhouse Park, as well as other estates in the neighbourhood, is famed for its brown oak. Until recently, when offered for sale, brown oak was sure to fetch a good price, but the demand has fallen off considerably during the last year or two. At one of the auction sales, about 15 years ago, one oak sold for £110. I understand it went to America to be cut into veneers. Another brown oak, also sold by auction, realised £60. Curiously, many of the smaller trees, particularly those that were brown to the top, and even a little tender, made more per foot than the large trees. For inside panelling and veneers, these old brown oaks will always be in demand, and it is gratifying to think, that in this at least, we can defy any foreign competition.

It is very difficult to form any idea as to how some oaks in the same wood are brown, and others, grown under the same conditions, are not; but I think it due, in all probability, to old age and the state of decay. On the same ground, where the trees felled were nearly all hollow and more or less decayed, some would come down a beautiful brown colour, while, close to, others would have a centre of a white spongy nature easily pulled out in handfuls. It will therefore be seen how difficult it is to arrive at a correct solution of the problem. Being situated on the South Yorkshire coalfield, we suffer considerably



BROWN OAK,
The Property of Earl Fitzwilliam
Length 31 ft. x 32 in. $\frac{1}{2}$ girth. 220 cub. feet.

.....

f

e

.

from smoke, which has the effect of killing many of the oak tops, and may be a contributory agent in some measure to the colour of the timber.

Up to 40 years ago, this estate was very heavily wooded, but since then large falls of timber have been taken down in all the woods and the park. The system employed was a fall every 21 years; and, unfortunately, the young timber planted had not time to make sufficient height growth when another fall was taken of the old trees standing among them, with the result that we have now to clean fell and replant. In Shire Oaks Wood, under the few old trees remaining, is a young planted crop, which is making no progress on account of the old trees standing above it. Lord Fitzwilliam therefore decided to clear and replant half of this wood. The old trees were cut, and in felling and removing these monster oaks, many of which contained over 200 feet of timber, quite half the young crop was destroyed. Below I give the girth of a few of the oaks and beech in the half of the wood left standing.

Close to where the tree (shewn in the photograph) was felled stands another magnificent oak, which I look upon as one of the biggest on the estate. The girth at 5 ft. up is 13 ft. 8 in. over bark, with a length of bole of 60 ft. This tree is quite healthy, with a beautiful head. Some of the other oaks' girth:—11 ft. 8 in., bole 40 ft., 13 ft. 10 in., 7 ft. 4 in., 9 ft. 9 in., 8 ft. 11 in., 9 ft. 4 in. All these have long clean boles of 40 to 50 ft. Beech girth:—12 ft., 11 ft. 7 in., 12 ft. 5 in. The first of these three has a bole of 40 ft., the other two 50 ft. long.

ROBERT Mc.GIBBON.

TIMBER SALES IN WORCESTERSHIRE.

THERE is a good demand for most kinds of timber in this district—and with the exception of oak, prices have been well maintained during the last few years.—Ash is in constant demand, and good prices are obtained for timber of good quality. Sweet chestnut, larch and poplar are also much sought after, the

chestnut in this district being as a rule of good quality, and practically free from ringshake.

English elm, to be found here in nearly every hedgerow, and sometimes called "the weed of Worcestershire," commands at present better prices than it has done for a number of years, 9d. to 1s. per foot being readily obtained, according to quality and distance from railway, while some years ago 6d. to 8d. per foot were common prices; but no doubt the large quantity of wind blown hedgerow timber in the West Midlands at that time accounted for this.

As the undernoted prices are for timber felled and measured with quarter-girth tape *over bark*, and include all limbs and tops down to 5 inches quarter-girth, the figures may not seem quite so attractive as those quoted from time to time in various papers as having been got for different lots of timber; but those writers who get what appear to be remarkable prices, usually omit to state how the timber was measured; whether with string or tape, what allowance, if any, was made for bark, and whether the limbs and tops were thrown in or sold at half-price, or, indeed, whether or not the timber was measured at all, as in a great number of cases the timber is sold standing, and without any real measurement said to contain a certain number of feet.

LOT 1.

No. of Trees.	Kind.	Total cubic Contents.	Price per foot	Remarks.
21	Oak	619 feet	1/4	Coppice grown.
19	Sp. Chestnut	899 "	10d.	No ringshake.
27	Larch	1,491 "	1/-	All above 12 in. quarter-girth, good quality.
2	Poplar	218 "	8d.	
7	Ash	634 "	1/6	Hedgerow trees, good boles, numerous limbs.
5	English Elm	363 "	10d.	
1	Spruce	32 "	6d.	
6	Birch	71 "	6d.	
17	Ash Poles	67 "	1/-	

All the above, close to a good road, 6 miles from railway station.

LOT 2.

No. of Trees.	Kind.	Total cubic Contents.	Price per foot	Remarks.
253	Larch	4,220 feet	10d.	Inferior quality, a number of the trees affected with dry rot. Very rough hedgerow trees.
6	English Elm	78 "	8d.	
18	Birch	142 "	6d.	Very rough hedgerow tree.
1	Beech	125 "	9d.	

Above lot, adjoining a good road, and within 2 miles of railway.

LOT 3.

No. of Trees.	Kind.	Total cubic Contents.	Price per foot	Remarks.
57	Larch	1,228 feet	10d.	Excellent quality, from 6 in. to 12 in. quarter-girth.
118	Spruce	1,775 "	6d.	
30	Beech	1,190 "	8d.	Fair quality.
25	Sycamore	553 "	8d.	Rough.
18	Oak	487 "	1/4	
34	Ash	442 "	1/4	Very poor quality, grown from old coppice stools.
14	Ash Poles	62 "	1/-	
3	Birch	28 "	6d.	Very poor quality, grown from old coppice stools.

This lot, adjoining good road, about 7 miles from railway.

LOT 4.

No. of Trees.	Kind.	Total cubic Contents.	Price per foot.	Remarks.
260	Larch	5,560 feet	10d.	Very long clean timber, first class quality. From 6½ in. to about 12 in. quarter-girth.

Above lot 6 miles from railway.

LOT 5.

No. of Trees.	Kind.	Total cubic Contents.	Price per foot.	Remarks.
81	Larch	709 feet	9d.	6½ in. quarter-girth, and under first class quality, used locally as pit-wood.
169	Oak Poles	1,063 "	7d.	Rough, coppice grown, used locally as pit-wood.

The foregoing afford a fair sample of the prices we have been getting recently in this neighbourhood. The terms of sale were cash, less $2\frac{1}{2}$ per cent., when the lots were measured up, and all timber to be removed before the 30th September following.

It would be a great help to all connected with the selling of timber to be able to compare prices; but prices, unless accompanied by a statement as to how the timber was measured, etc., are of no value for purposes of comparison. It would, indeed, be an excellent thing, as suggested by Mr. J. P. Robertson in the last copy of the "Journal," if a fixed standard for timber-measuring could be adopted for general use throughout the country, and for this purpose I can strongly recommend the tape-over-bark method of measuring as one that practically does away with all cases of dispute, and while being perfectly fair to both buyer and seller, is the quickest, simplest, and most efficient I have ever seen in use.

J. B. BRAID.

Reviews.

"INDIAN TREES.*"

The number of species dealt with by Sir Dictrich Brandis in this work is over 4,400, whilst the area embraced is the whole of the British Indian Empire. It is not surprising, therefore, that eight years have elapsed since "Indian Trees" was begun, and that the list of addenda bringing the information up to date is a long one.

The author informs us in his introduction that the object of the work is restricted and entirely practical, but besides interesting forest officers, district officers and professional botanists, we are confident that the book will be welcomed by a considerable section of the public interested in the woody plants of the Indian Empire. It will be useful to persons who are responsible

* By D. BRANDIS, K.C.I.E., F.R.S., etc., etc,
Archibald Constable & Co., Ltd., London, 1906, pp. i-xxxiv. and 1-767, 22s.

for planting roadside trees in India, and to arboriculturists generally, as well as to travellers who desire to learn the names of the trees that attract their notice. There must be many residents in India who like to have handsome trees and shrubs growing in their gardens or compounds, and who desire to learn their scientific names and all about them. Others again, who use a deal of timber or the various other economic products of the forests, will find "Indian Trees" very valuable. Much money may be saved by the use of a reliable text book such as this, giving precise scientific descriptions of the plants with which it deals. An example of this in connection with the adulteration of *Strophanthus* seeds occurs in the *Kew Bulletin* for 1895, p. 243. It would be interesting to know whether any of the Indian species of *Strophanthus* can compete with the official kinds.

"Indian Trees" is admirably adapted for use by those who are unpracticed in the identification of plants by means of written descriptions, thanks to the great care and lucidity with which those it contains have been drawn up. The illustrations, over two hundred in number, will also be of great assistance, and, as they are well distributed throughout the book, they will serve as frequent finger-posts to point the way to the recognition of allied species. The work has been most opportunely published at a time when scientific research regarding the economic products of the forests of India has received a fresh impulse. It brings into one volume the most recent information regarding the trees, shrubs, woody climbers, bamboos, and palms, indigenous or commonly cultivated in the British Indian Empire, a circumstance which, we trust, will greatly help towards the collection of material still needed for a second edition of the *Flora of British India*.

The author expresses the hope that his work will facilitate the preparation of local forest Floras for those botanical areas where they are lacking or in need of revision. We are confident that this hope will be realised as a result of the impetus given by the present work, and that progress will be more rapid than in the past in the production of such local volumes.

Sir D. Brandis' advice to the authors of such Floras will bear repeating. He says :—" The number of species is too large in India ; it is essential that these local handbooks should be small and easily portable. The authors of future local floras must try to facilitate the identification of their principal timbers by means of keys to their structure, and be content with the humble task which I have set before me in the present book to make the work of determining the names of the species constituting their forests easier than it is at present." These are wise words, which ought to encourage even the most modest worker to contribute to the general fund of knowledge any new facts of interest that may come under their observation.

On pages xxi. to xxiii. of his introduction, Sir D. Brandis indicates several directions in which research is needed. He tells us that his " ambition has been to publish a path-finder through the bewildering variety of trees, shrubs, climbers, bamboos and palms which constitute the forests of the different provinces of India. I do not maintain that foresters ought to know them all, but they ought to have the means of making themselves acquainted with them without undue loss of time." The work is an excellent one for the purpose, and will certainly be welcomed by the forest students at Oxford who are destined for service in India. They could not have a better textbook for their studies ; it is a book which will be permanently useful to them throughout their career and should not be thrown aside. Indeed, " Indian Trees " should be in the possession of every forester in the Indian Empire, and often referred to. There is only one fault to be found with the book, it is too bulky. Sir D. Brandis admits this, but if it should be found inconvenient to carry the book always on tour, this very inconvenience will remind officers that, as our author points out, small and easily portable hand-books are still needed.

We heartily congratulate Sir D. Brandis upon his magnificent achievement, and trust that this great and useful work will be appreciated as it deserves. The publishers (Archibald Constable and Co., Ltd.) have merited the thanks of all users of this work for the admirable manner in which it is issued. The binding is good and strong, the book opens out flat and the print is easy to read. The paper seems to be good if a trifle too heavy.

F. B. M.

"THE TREES OF GREAT BRITAIN AND IRELAND."*

In this handsomely prepared work, the authors intend to describe and figure all the timber trees which are native to, or have been introduced into Britain; above 300 in number. The botanical descriptions are accurately drawn up by Dr. Henry, while photographs, which have been carefully selected from a large number obtained by Mr. Elwes at an immense amount of labour and expense, have been excellently reproduced by the Autotype Company, of London, who guarantee their permanency. The measurements of the various trees have been very carefully taken with Stanley's Apomecometer. The portions of the work done by each author is identifiable. Owing to the necessarily high cost of this splendid work (£15 15s.), it would be very useful if a cheaper edition of the letterpress were eventually published for the use of woodmen and landscape gardeners. A vast deal of labour has been expended on visiting the different trees, both at home and in their native countries.

Naturally, when a work of this calibre on British trees is issued, one seeks for a comparison with the monumental "American Silva" prepared by Sargent, in which the American trees are described in botanical sequence, and the portions of foliage, flowers and fruit excellently figured for the purpose of botanical recognition. These volumes, however, have no definite botanical sequence, owing to the book coming out in parts, and the authors being obliged by degrees to find out innumerable small details as to the immense number of rare trees scattered over Great Britain. The first group described are the northern beeches, under this is given a key to the species of *Fagus*, of which seven are described. Our own species has 13 varieties enumerated. The authors hold that the Beech is indigenous, remains of it being found in neolithic deposits at Southampton docks, and in Essex, and in pre-glacial deposits in Suffolk and Norfolk. They also state that names of places of Saxon origin in which the word beech occur are very common, as Buckingham, Buxton, Boxstead, Boxford,

* By HENRY JOHN ELWES, F.R.S., and AUGUSTINE HENRY, M.A.,
Edinburgh, privately printed, MCMVI., vol. i. pp. xiv. 200., H. 60.,
with a preface by Sir W. T. Thistleton-Dyer.

Bickleigh, Boking, etc. At least one of these places has been claimed, however, to show that the Box (*Buxus*) was connected with the place. A coloured figure is given of the Queen Beech at Ashridge, Herts., which reaches a height of 135 feet, with a growth of 12 feet 3 inches, and its bole stretches branchless for about 80 feet. Another magnificent tree existed at Mr. Watney's Park at Cornbury, where the beeches were probably planted under the advice of Evelyn, which was 120 feet high, with a growth of 21 feet 4 inches. The trunk split into two nearly equal and vertical branches of magnificent proportions. This fell in the autumnal gale of 1903. Valuable information is given as to the soil and situation most favourable to the beech and other trees, and also as to the diseases to which trees are liable, with the best remedy known. Under the beech, reference is also made to the great beech forest of France, where, at Lyons-la-Forêt, there is a tree 147 feet high. The world distribution of the beech and other trees is also given. The economic side of forestry is also touched on, and Professor Fisher's instructive article on the Chiltern Beech Woods (*Land Agents' Record*, April 9th and 16th, 1904), is cited. The interesting specimens of the Beech throughout England are also mentioned, so that the reader will see how complete in detail is this work and how indispensable it will be to every large landowner in the British Isles.

As an example of the excellent Plates the one of a beechwood near Petworth is reproduced as a frontispiece..

Next to the beech follows a description of the Chinese *Ailanthus glandulosa*, which is said to have been introduced to Britain in 1752, and the authors show that the name Tree of Heaven now generally applied to this species, really belongs to the tropical *Ailanthus*, described by Rumphius. The largest tree in Britain appears to be that at Belton Park, which is 83 feet high, with a girth of six feet.

Then comes an account of the Japanese Sophora (*S. japonica*), which appears really to be a native of China, a most beautiful tree, of which a very fine specimen exists in the botanical gardens at Oxford, 65 feet high, one at Cambridge being still finer.

The sections treating of the yew contain much new matter, and the plates, representing tall columnar yew trees at Mid-

hurst, will be new to many arboriculturists. The treatment of the genus *Pyrus* is very interesting and valuable, both from a botanical and forestry point of view, the plate of *P. latifolia* representing the largest tree known of that species.

Enough has been said to show how excellent this work is, and there is little doubt, as in Mr. Elwes' book on the Lilies, those who purchase it notwithstanding its necessarily high price, will make a good investment, not only from the amount of information the work contains, but also in a pecuniary sense.

G. CLARIDGE DRUCE.

"FOREST PROTECTION."*

The second edition of Forest Protection, by W. R. Fisher, has recently appeared as Volume IV. of Schlich's Manual of Forestry. It now embraces over 700 pages, costs 12s., and is published by Bradbury, Agnew & Co. In every way this is an admirable work. It deals with the protection of woodlands against every sort of damage, injury in felling and removing timber and other forest produce, damage from game and vermin, from weeds, fungi, frost, sun, drought, floods, fire, smoke, and notably insects. Naturally one turns to the section of this veritable encyclopædia that interests one most, and as a rule everything of real use to the forester will be found clearly set forth. If one part of the work is deserving of more praise than another it is that which deals with forest entomology. No work in the English language can approach this for extent and accuracy of information in regard to the life-history of forest insects, and the preventive and remedial measures that may be practiced against them. Probably the insect that gives most trouble to many British foresters is the pine-weevil, and if certain of the directions set forth in the work under review were carefully followed, this destructive pest would cause less anxiety. Systematic trapping by means of pieces of fresh coniferous bark, for instance, has often saved a young plantation from destruction, and already the practice is in operation on many British estates.

This book is an English adaptation of Hess' Forstschutz, and naturally it contains a certain amount of material that does not apply to conditions in this country directly. On the

*Schlich's Manual of Forestry, Vol. IV., 2nd edition, 1906, by W. R. FISHER, M.A. Cantab, et Oxon. London: Bradbury, Agnew & Co.

other hand, certain points that were unknown to the German author might with advantage have been added. Reference, too, might have been made to the work of the Royal English Arboricultural Society in collecting statistical data on the effects of frost and on larch disease, though perhaps it may be assumed that these reports are generally known to English readers. But, with due allowance to the difficulties of adaptation, it is an admirable work, and one that no English-speaking forester can afford to dispense with. W. G.

"ARBORETUM NATIONAL DES BARRES.*"

This work, though completed five years ago, has only just been published, and a copy has been presented by the author to our Society, for which I tender him my very cordial thanks.

M. Pardé, while a Professor at Les Barres, made a careful study of the trees growing in the Arboretum there, and has described them from the point of view of a practical forester with a clearness, accuracy and knowledge which, perhaps, no one else in France possesses to an equal degree. Basing his work on a catalogue written by M. Dubreuil, and published in 1878, he has added notes on the species there mentioned, bearing on their adaptability to cultivation and silvicultural requirements in France, together with opinions formed on the trials which have been made of them in Germany by Schwappach, Hartig and Mayr, and in Austria by Cieslar. A large number of photographs of the trees growing at Les Barres, and taken under M. Pardé's supervision, are reproduced in an album which accompanies the letterpress, and though their execution is not faultless, they give a good idea of the comparative growth of the trees.

The domain of Les Barres is situate some fifty miles south of Paris, on rather poor sandy soil of moderate depth overlying an impermeable clay. Though the rainfall is not stated, the climate is described as dry, and the lowest temperature recorded is -32° C. in 1879-80; but spring frosts do not seem to be so harmful as in some parts of England, neither is the wind, as a rule, so dangerous to trees as in many places. The property

*Arboretum National des Barres, by L. Pardé.

Paris: Paul Klincksieck, 1906.

was purchased in 1821 by Pierre Philippe André de Vilmorin, grandfather of M. Maurice de Vilmorin, the present head of the firm of Vilmorin, Andrieux & Co., of Paris. At that time there were no trees on the property except a few worn-out stools of oak and hornbeam, but with the object of learning which were the most valuable forest trees for France, M. de Vilmorin procured from many different sources the seeds of forest trees, and planted them in such a manner as to test their suitability for economic planting. In 1860, the property was taken over by the State, and in 1873 was converted into a practical School of Silviculture, which has since been considerably developed under the auspices of M. Daubrée, Directeur Général des Eaux et Forêts in France. As a general rule it may be said that the opinions expressed by M. Pardé, though derived from experience in a climate where the summers are longer, hotter and drier, and the winter frosts more severe than in most parts of England, are very similar to those which I have formed from observation of the growth of exotic trees in England. It must, however, be remarked that the soil of Les Barres is not so good as it ought to be for the successful growth of many of the trees mentioned; and though several species of oak, hickory and pine, which either will not grow at all in England, or grow so slowly and badly that they are not worth planting, succeed fairly well at Les Barres, yet the height and girth of many other species, especially of conifers, is inferior to that which they attain in this country. It is a pity that M. Pardé, in writing this work, has confined himself to the trees at Les Barres only, because several species of great interest and probable value are not included; while, on the other hand, a number of woody climbers and plants such as Thyme, Lavender, and Polygonum, which have no place among trees at all, are dealt with, and many of the more newly introduced species are as yet far too young to enable a fair judgment to be made of their qualifications for economic forestry. The lessons which have been already learned from these experiments have proved so useful that we cannot too strongly press on our own government the importance of undertaking some similar experiments on a well chosen site in England, and I venture to affirm, without hesitation, that such trials cannot be successfully carried on for a sufficient length of time to make them really conclusive

unless they are assured by a permanent financial guarantee and are under the direction of a really practical and scientific forester; for though a great deal has been done on the Continent, the experiments are still inconclusive as to many important questions, and even if sufficient for other countries, are of uncertain application in England on account of the great difference in climatic conditions. The great difficulty in all such experiments is to find a site where the soil and situation vary enough to suit even moderately well a large number of species, for nothing has struck me more in England than the immense influence on the success of many trees of what seem very slight changes in local conditions.

I will now give a more detailed sketch of the result of the 70 years trial at Les Barres on some trees well known in England. Among the group of Cypresses, *Thuja gigantea*, *Chamaecyparis Lawsoniana* and *C. Nootkatensis* are in M. Pardé's opinion, as in mine, the most valuable exotics; *Cupressus obtusa* suffers from drought and autumn frosts, and *C. macrocarpa* is not hardy in the north of France. *Juniperus Virginiana* is recommended for trial as a forest tree; it ripens seed and has reproduced itself naturally in France, but I have rarely seen fruit and no self-sown seedlings in England. *Cryptomeria Japonica* finds the soil and climate too dry. *Taxodium distichum*, which ought to grow well in the warm south-west of France, does not seem to flourish at Les Barres as in England. Neither *Sequoia gigantea* nor *S. sempervirens* do so well as with us; the latter was killed to the ground in 1871-72.

As to the genus *Pinus* there is much to be learned from these trials. *P. Laricio*, *calabrica* is the one which has given the best results, though as the source of the original seed is not certainly known, and so far as I can learn from M. de Vilmorin, it is not clear that the seed which I procured four years ago from the Sila mountains is identical in parentage. None of the American pines appear to grow sufficiently well under ordinary conditions to make them valuable in France, though *P. Strobus* succeeds where the soil is cool and moist enough, but *P. resinosa*, *P. pungens*, and *P. mitis*, though they grow better than I have seen them in England, are not at home anywhere in France. *P. Banksiana* which has been so much recommended in Germany, but which so far as I can see is absolutely worthless in England, has not been tried at Les Barres; and *P. rigida*, as in England,

is the only so-called Pitch Pine which is hardy there, though the true Southern Pitch Pine, *P. palustris*, has grown to a large size in the south west of France.

None of the Spruces appear to equal the common Spruce as forest trees, though *Picea orientalis* and *P. Omorika* of which my own experience is very favourable, are considered worth a trial. *P. rubra*, an exceedingly rare tree in Europe, is well distinguished and highly spoken of by our author for planting in cold, wet places; it has attained at Les Barres about 60 feet high by 4 in girth and has reproduced itself naturally. Of *Pseudotsuga Douglasi*, M. Pardé does not express a very definite opinion as regards its success in France, though he quotes the favourable opinions of Schwappach, Cieslar and Berger, and wisely adds a warning not to plant it on soils too dry or calcareous, not to cut it too young, nor until it has had time to form a large proportion of heartwood. Of the Silver firs, *Abies Nordmanniana* receives the highest commendation, though none of the German foresters consider it superior to the common Silver fir. *A. Pinsapo* is considered to be the best for calcareous soils and localities too hot and dry for the indigenous species.

There are several remarkable omissions amongst the broad-leaved trees; for instance, *Magnolia hypoleuca*, though very highly spoken of in Germany, and already ripening its seeds in Northern Italy, is not mentioned; the Elms also seem to be insufficiently represented at Les Barres to allow a careful study of that difficult genus. *Zelkova crenata* and *Z. acuminata* are both highly spoken of on account of the excellent quality of their timber, which I can from personal knowledge fully confirm, but it seems doubtful whether they can in France or England be profitably grown as timber trees. Of the Planes, M. Pardé seems to speak with insufficient knowledge, and I remain in doubt whether in alluding to *P. occidentalis* as a species actually naturalized in France he really means as I suppose, *P. acerifolia*, which he does not mention, though most of the Planes I have seen in France, as in England, are of this form. The Hickories seem to grow well at Les Barres, *Carya alba (ovata)*, *C. amara (minima)* and *C. porcina* all reproducing themselves

naturally, which, so far as I know, they never do in England, and of these the former is recommended for sowing as a forest tree together with *Juglans nigra*, which the author thinks, as I do, superior to the common Walnut as a timber tree. As to the three forms known in France as Canadian, Virginian and Carolina poplars, which are considered distinct species both by botanists and timber-merchants, though Sargent unites them, M. Pardé tells us how to distinguish them, but says little of their relative economic value, which is far better known in France than in England, and what he says about the wood of *Populus nigra* leads me to doubt whether the tree which he knows by that name is the same that we have in this country.

When we come to the oaks, however, especially the American oaks which were long ago introduced into France and largely planted at Les Barres 70 or 80 years ago, we have a great deal of valuable information. Briefly it may be said that *Quercus alba* exists, but it will not thrive anywhere in France; *Q. macrocarpa* grows but little better; *Q. coccinea* and *Q. rubra* reproduce themselves, the latter is considered to rank next to the native oak in general utility; next to it *Q. palustris*, which also reproduces itself freely both in France and Belgium, has gained a high place in the estimation of practical men, and its wood is more appreciated in Belgium than in America, Houba saying that it is very superior to that of the Red oak.

Space will not allow me to allude to many other interesting points which are dealt with in this book, but it is one that should be in the hands of every forester who understands French, and is in my opinion a more reliable guide than some recently published works in English, which deal more or less superficially with the same subject.

H. J. ELWES.

CONTENTS.

	PAGE
ERRATA TO APRIL NUMBER	203

CURRENT TOPICS AND SHORT NOTES :—

Irish Forestry Society	204
Destructive Insects and Pests Bill	204
Insect on the Larch. By W. Somerville	204
" " " By J. Bennett	205
Mr. Fisher's Lecture on Coppice-with-Standards and Larch Woods, at Carpenters' Hall	207
Dr. Henry's Lecture at Oxford, on the Forests of the Rocky Mountains, Spain, Corsica and Algeria	211
Planting at Sulby Glen, Isle of Man	213
Financial Statement of the Clearance of a Wood in Yorkshire. By W. B. Havelock	214
Honey Fungus on Cedar. By R. L. Anderson	216
Sale of Oak Timber in N. Lincolnshire. By W. B. Havelock	217

OBITUARY :—

Hon. Mark Rolle, Professor Karl Gayer, Sir D. Brandis, Mr. Boppe, Dr. Masters, Mr. P. Baylis	218
---	-----

ORIGINAL ARTICLES :—

Conversion of Underwood into High Forest. By R. L. Anderson	219
Mismanagement of Quick Fences in England. By E. R. Pratt	221
Life-History of the Beech. By G. T. Boulger	230

	PAGE
REVIEWS AND NOTICES OF BOOKS :—	
"The Laws of Private Forests." By Jules Madelin	280
"Arboretum de Tervueren." By C. Bommer	281
"Journal of Economic Biology"	282
"Quarterly Bulletin of the Imperial Institute," No. 1, 1907 .	282
"The Indian Forester." February Number	283
OFFICIAL PAPERS :—	
Railway Rate Committee Reports	284
Irish Forestry Society : Annual Meeting and Report ; List of Members	289





ARGYRENTHIA LAEVIGATELLA H. SCH. ON LARCH.

Sent by Mr. J. Bennett, Wolverton, Basingstoke.

Quarterly Journal of Forestry.

No. 3.]

JULY, 1907.

[Vol. I.

ERRATA TO APRIL NUMBER.

PAGE 145, line 3, for <i>Clarendon</i> , read Carnarvon.	
„ 148, „ 20, „ <i>preparation</i> , „ preservation.	
„ 151, „ 35, „ <i>Ward</i> , „ Maw.	
„ 176, „ 21, „ <i>Laris</i> , „ Larix.	
„ „ „ 23, „ <i>danurica</i> , „ Dahurica.	
„ „ „ 24, „ <i>Leptolepsis</i> , „ leptolepis.	
„ „ „ 28, „ <i>ditto</i> „ ditto.	
„ 181, „ 7, „ <i>feet</i> „ to.	

Dr. Henry writes as follows respecting the spruces referred to on page 177.

Picea Hondoensis is commonly, but erroneously, known in gardens as *P. ajanensis*, or *P. Alcockiana*. *P. Hondoensis* and *P. ajanensis* are two distinct species; according to Mayr, they belong to the section *Omorica*, and are flat-leaved spruces. They are very similar and though kept separate in the "Trees of Great Britain and Ireland," 85, 89, are probably only varieties of one species. *P. Hondoensis* is commonly cultivated in Britain. *P. ajanensis* occurs in Manchuria, Saghalien and Jezo, it is rare in Britain; *P. Hondoensis*, in Hondo, the main island of Japan. *P. Alcockiana* is an entirely different species from the mountains of Central Nippon, it is also rare in Britain, belonging to the quadrangular-leaved section; it has very distinct cones, &c. Very often *P. ajanensis* is erroneously named *P. Alcockiana*, but it must not be confused with the flat-leaved Japanese spruce. The mistake arose owing to mixture of seeds when first brought over.

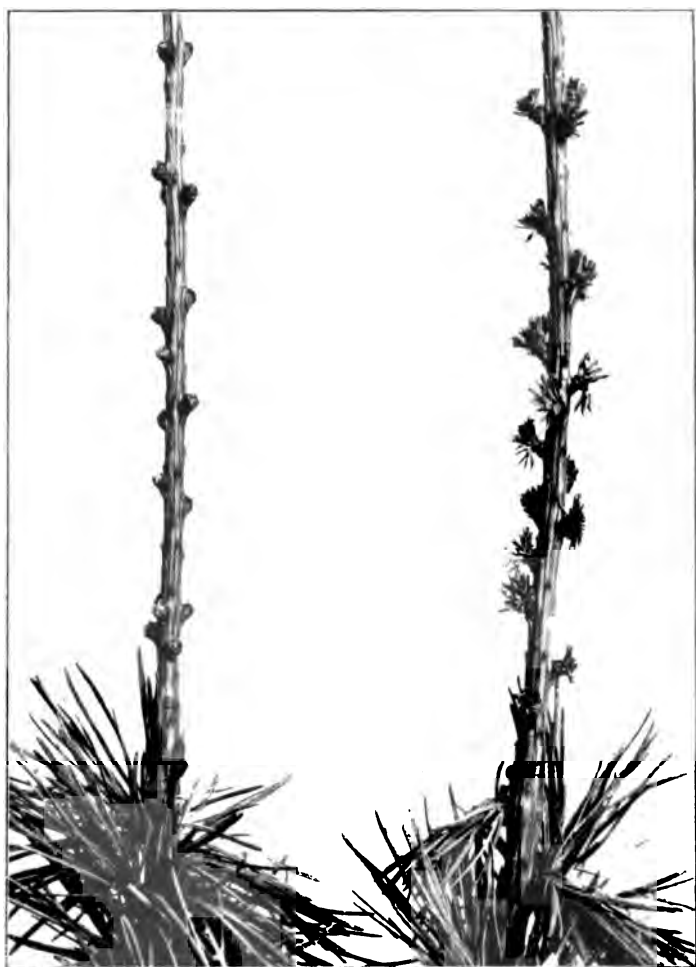
Current Topics and Short Notes.

Irish Forestry Society.—The fifth annual general meeting of the Irish Forestry Society was held at the Mansion House, Dublin, on April 18th. An account of the meeting together with the annual report of the Society, the list of members and statement of accounts, appears on p. 289.

When the last Irish Land Act was passed by the late Government, under Mr. Wyndham, a great opportunity of afforestation was missed. The mountain and wasteland unsuitable for agriculture might have been gradually acquired by the State and handed over to the County Councils for afforestation, under tutelage by the State Department of Agriculture. The woods planted would be county or district council woods, similar to the communal forests on the Continent, and the supervision being vested in the State would have ensured good management. This land could still be acquired at very low prices, and the measure, if still possible, would be hailed by all classes of Irishmen as a great act of statesmanship. Nowhere outside the Pacific Coast of North America would timber grow better than on some of the Irish mountains with their heavy rainfall.

Destructive Insects and Pests Bill.—This Bill, which will give increased powers to the Board of Agriculture in the matter of preventing the spread of insect pests and fungus diseases, was read for the third time in the House of Lords on Monday, May 13.

Insect on the Larch.—In the district round Oxford, larches up to twenty years of age have been much injured during the past autumn and spring by the attack of a small caterpillar (about one-third inch long) that lives between the wood and bark of the shoot formed in the previous year. In consequence of the damage the shoot dies and in the case of a



LARCH SHOOTS ATTACKED BY ARGYRESTHIA LAEVIGATELLA H. SCH.

Sent by Mr. G. H. Grosvenor, New College, Oxford.

bad attack the tree may be killed outright, and in any case is much crippled.

During the greater part of May, the caterpillar is at work as described, and towards the end of the month, or in June, it changes into a chrysalis, and shortly afterwards the moth appears.

The insect was first brought to my notice by Lord Moreton, and I have since received useful information in regard to it from Mr. Blair, the agent at Sarsden.

In larchwoods that I examined at Sarsden I failed to find the insect on the few Japanese larch that were available for inspection, but Professor Schlich has since shown that this species is not immune from attack, as Japanese larch in Bagley Wood, near Oxford, are similarly injured.

Mr. Grosvenor, who teaches forest entomology at Oxford and has supplied the accompanying plate, believes that the insect is a small moth (*Tinea* or *Argyresthia laevigatella*, H. Sch.), and the account in continental literature of the work of this pest leaves little doubt that his diagnosis is correct. But until the moth has emerged (and at the time of writing this has not taken place), the identification cannot be regarded as quite settled; meanwhile foresters are advised to see if the insect has been at work in the woods under their charge. After the middle of June the galleries under the bark are likely to be empty, but if a few of the affected shoots are forwarded to the Forestry Department at Oxford, the cause of injury can be determined. The question of the distribution of the insect in Britain is a matter of much interest and no little importance. Mr. Grosvenor has failed to discover any reference to it in English entomological literature, so that it would appear that we have to deal with an insect that has not hitherto been recorded as British. If on more exhaustive enquiry this should prove to be correct, the assumption is justified that the insect has been introduced from the Continent quite recently, in which case it may not be by any means widely distributed. Definite information with regard to this is much to be desired.

OXFORD, May 20, 1907.

WM. SOMERVILLE.

“*Argyresthia laevigatella*” on Larch.—Larch-blister and the attacks on larch by various pests that this valuable

tree is liable to has been discussed from time to time with much earnestness and also the best means to cope with them.

Now I venture to say that few attacks are more interesting and (unfortunately) more destructive than those of *Argyresthia laevigatella*, which has made its appearance near Basingstoke in Hampshire, and bids fair to be one of the most disastrous pests.

The first sign of this attack can be noticed in May, when about two-thirds of the previous year's growth of the side-shoots can be noticed turning brown and having a dying appearance, and on close examination it will be found that the twig has been bored in almost every case about 1 to 1½ inches from the commencement of the year's growth by a very minute larva.

The dying appearance and the failing of the buds to develop attracted my attention in May, 1906, and from close observations since then, I find that the insect swarms about the end of May or the commencement of June, and the eggs are deposited on the lower parts of the shoots of the current year (including the main shoots), about the end of June or the commencement of July. The grub soon hatches out and eats its way under the rind, where it passes the winter.

In the following spring it recommences feeding on the living cortex and cambium, till finally these tissues are destroyed in a complete ring around the twig, which dies away above the part attacked.

The pupation takes place in May, thus the damage done during the previous autumn and the early spring becomes first visible in April or May by the twigs dying off.

Preventive measures are very difficult in the case of an attack like this, and I think a great deal depends on the weather and vigour of the plants in resisting the attack, but I should be glad, through the JOURNAL, to hear of any practical suggestions.

I may also say that this insect has not hitherto been regarded as a very destructive enemy of the larch, and the case is worthy of further investigation.

The frontispiece shows an eight-year-old tree attacked in June or July, 1906, the ends of twigs being dead.

I have also observed that trees attacked in 1905 were again

attacked in 1906 with greater force than trees that escaped in 1905, thus showing that the insect confines itself to particular areas when once settled.

JOHN BENNETT.

Lecture on Coppice-with-Standards and Larch Woods at Carpenters' Hall.—A condensed report of this lecture, given on March 21st, by Mr. W. R. Fisher, appeared in the *Land Agents' Record* on April 13th, and the whole lecture has since been printed by the Carpenters' Company. The Right Hon. Earl Fortescue presided, and there was a large audience. The following extracts from the lecture give statistics of the prices of underwood in various English districts :—

Coppice-with-standards, or copse, is probably the best system of forestry for the private owner on all land good enough to produce good standards. It is useless on very poor sandy land, where pines should be grown, and on land above the chalk it is better to grow beech high forest ; but there is no better system for loamy land where the subsoil contains sufficient moisture. Anyone who wishes to see the system at its best should visit the woods of Chenoy, belonging to Mr. Buol, a Belgian senator living at Villers-la-Ville, close to the battlefield of Quatre-bras. This wood is described in the Transactions of the Royal Agricultural Society for 1905-6. It consists of a number of folds of land, alternately sand and loam. The sand, 750 acres, is stocked with pines, while the loam produces 1,000 acres of coppice-with-standards, the rotation of the underwood being eighteen years. There are also 337 acres of simple coppice without any standards. The value of the underwood is only £2 16s. per acre, or about 3s. per acre annually ; but the sale of the standards, which are very fine oaks, ash and beech, produces about £40 per acre every eighteen years, so that over £2 per acre is obtained gross on the best land. The total gross revenue for 2,280, acres, bad and good, including some bare heather land, is £3,750, or £1 13s. 5d. per acre, and the expenses are covered by the value of the game. Belgium is a country resembling

our own closely in its economic conditions, but forestry there is more advanced than with us.

I refer to this wood, as many owners are discouraged by the low value of their underwood now that hop-gardens use so much wire, and much hoopwood is imported from France, where it is grown scientifically. I doubt, however, if less than 3s. per acre annually is often obtained in England for good underwood. At Castle Hill, in North Devon, belonging to Earl Fortescue, with underwood averaging twenty-five years old, it yields net £3 4s. per acre, or about 2s. 6d. per acre annually, but the soil is excellent for oak and ash standards, and when well stocked with these the standards should easily yield 22s. 6d. per acre, making the total yield of the woods 25s. per acre. The chief underwood in Castle Hill is alder, which sells at 16s. a ton at Barnstaple for toys and broom-heads, and it is proposed in future to grow on the stiffer soil there alder and ash underwood, but with a good stock of standards. The lighter land will be chiefly under larch.

I have seen alder underwood on wet soil, near Cooper's Hill, 45 feet high, and with stems 2 feet round at the base, in twenty-five years. Such alder underwood forces up oak and ash standards into long boles, and there is a classic example of such a wood at Kippenheim, in the Grand Duchy of Baden. There the alder underwood in thirty years is fully 60 feet high and 3 feet in girth at chest height, only three or four shoots being left to each clump, the weaker ones being removed in the thinnings, made every five years, from twenty years upwards. The oak and ash tower above the underwood, having clear boles 60 feet long, and are extremely valuable, while the alder wood is sawn up into planks for cigar-boxes, etc.

In the High Meadows Wood, underwood twenty-five years old was in 1897 sold at £5 per acre, or 4s. per acre annually. All the larger poles were used for pitwood. There are some compartments with beech underwood. It has been recently asserted that beech cannot be coppiced, and it is certainly true that beech is usually a bad species for coppice; but there are thousands of acres of beech coppice in the Pyrenees. I do not, however, recommend beech for underwood.

In Lord Bathurst's woods at Cirencester the underwood, chiefly of ash and hazel, is cut when twenty years old, but has been injured by rabbits. It used to be sold separately from the overwood, at £8 per acre, or 8s. per acre annually, but now fetches only £6 per acre, or 6s. annually, being sold with the standards. Personally, I prefer to sell underwood separately, as the merchants who want standards do not care for underwood, and buy it only to sell again. The method of cutting this underwood is admirable.

In all the woods I have alluded to there are splendid standards, in Castle Hill chiefly of oak, in High Meadows and Lord Bathurst's woods of oak, ash and larch. The larch standards in the latter woods are magnificent, the larch selling at up to 1s. 3d. a cubic foot for barge-building. These trees are 55 feet to 60 feet in the bole, with girths at chest height of 8 feet, and worth about £6 each. At another wood in Gloucestershire, last year, £14 per acre was obtained for pure ash underwood sixteen years old, or 17s. 6d. per acre annually; * but rabbits like ash, and that is why this valuable species is becoming so rare.

I should like to note here that these splendid woods of Lord Bathurst's are growing on flat strata of oolitic limestone, not more than a foot or 18 inches below the surface of the ground, and it is only because the soil is continuously under a crop of trees that such fine standards and underwood is obtainable.

A most excellent wood as regards the underwood is that of Oxshott Coverts, in Surrey, near Esher and Leatherhead. It is managed for the Crown by Messrs. Clutton, who have very kindly furnished me with financial data. They constantly cut out, at each felling, worthless underwood, and replace it with ash, hazel and sweet chestnut. This woodland is on the London clay, some of which is so stiff that the growth of standards is impossible, though ash and sweet chestnut underwood grow very well. For the sale of about 49 acres of

* Since I gave this lecture, I have ascertained that small samples of ash underwood twenty years old, near Kettering, have recently been sold at 8s. 9d. a pole. This gives the enormous price of £70 per acre, or £3 10s. per acre annually, so rare and valuable has good ash underwood become. Unfortunately only small patches of ash underwood occur in this wood.—ED.

underwood in 1905 they obtained £182, being £3 14s. an acre, or 7s. 8d. per acre annually, with ten years' rotation; they realised at the same time £117 for the standards, or £2 7s. per acre, equal 4s. 8d. an acre annually; but there were also six acres of worthless underwood felled by the woodman, on which £62 was realised for the standards felled, or £10 3s. 4d. per acre, so that the total revenue from this wood in 1905 was £361 for 55 acres, or £6 11s. 3d. per acre for ten years' growth, equal to 13s. 1½d. per acre annually. As the produce of the wise planting of good underwood during the last twenty years becomes saleable, the revenue of this woodland will steadily increase, especially if more standards are raised on the better parts of the area.

I recently visited an estate on the London clay, that of Stisted Hall, near Braintree, in Essex, the property of Mr. C. Montefiore, where on about 148 acres the underwood, chiefly sweet chestnut, ash, and hazel, attains a height of 25 feet in fourteen years, and is made up by estate agency into hurdle wood, poles, thatching wood, pea sticks, birch bundles, and faggots, and after paying all the costs of conversion yields £3 10s. per acre net, or 5s. per acre annually.

The above remarks show that in Surrey, Essex, Gloucestershire and Devonshire, and I have no doubt in many other counties, especially in Northamptonshire, where good ash underwood is produced, the net returns for underwood vary from 2s. 6d. to 17s. 6d. annually. In the Belgian forest I have referred to they are only 3s. an acre, and in a French private forest—that of Raismes, near Valenciennes—for fourteen years' growth, about 5s. per acre annually, certainly no better than our own. It is therefore clear that, as a rule, no great returns can be obtained from underwood, though existing figures may be improved by keeping down rabbits and by gradually substituting the most valuable species of underwood that the locality can produce. Prices of underwood formerly were much higher. Mr. Anderson states that the average rate per acre of Lord Bathurst's underwood used to be £8 per acre, and that good ash underwood there sold for £12, being at rates of 8s. and 12s. per acre annually. In this case, he admits that rabbits have been the chief cause of depreciation. In spite, however, of the present

low value of underwood, I am not in favour of any change of system, except where good standards cannot be grown. My plan is to maintain the underwood, which should be ash, alder or sweet-chestnut, to cover the ground, and to draw up the standards and give them good boles, but to trust to the standards for the chief source of income, and to multiply them by planting, without altering the system by overcrowding the standards, each of which should have ample room to grow. The reason why Continental woods of this class beat ours is because whenever old standards are cut they are at once replaced by fine young saplings. It is not sufficient, as is done in most English copses, to trust to the natural regeneration of the standards by seed. This may act fairly well where the rotation of the underwood is not more than ten years, and the underwood itself is not growing vigorously, but with longer rotations and a strong underwood saplings should be planted to fill vacancies the autumn after a felling.

Lecture at Oxford, on the Forests of the Rocky Mountains, Spain, Corsica and Algeria.—On May 2nd, Dr. A. Henry gave an interesting lecture to the Ashmolean Nat. Hist. Society, at Oxford, illustrated by numerous lantern slides from photos taken by himself on his recent tour in the forests of the Rocky Mountains, Spain, Corsica and Algeria.

The first slide was a rainfall map of the British Isles, and showed the great rainfall of the west of Great Britain and of Ireland. Next came a similar map of North America, where the heavy rainfall of the districts contiguous to the Pacific Ocean render them climatically similar to the west of Great Britain and Ireland. This heavy rainfall area, from the Sierra Nevada, where *Sequoia gigantea* occurs, with the coast forests of redwood (*Sequoia sempervirens*) on the hills and up to the south of Alaska, is principally composed of Pacific Douglas fir. At the foot of the hills there was formerly a belt of *Picea Sitchensis*, not a mountain tree, but this has largely disappeared under the axe. *Picea Engelmanni* is the mountain spruce of this region. In Montana, in the Rocky Mountains, are extensive forests of *Larix occidentalis*, that is distinguished by its great length of bole and small branch development. Along the watercourses

are poplars. *Larix Lyallii*, a rare larch, is found only on northern slopes. Where the forest region approaches the drier region of the prairies *Pinus ponderosa* occurs. On rocks and in exposed situations along the coast, *Pinus contorta*, quite a small pine, is found. Dr. Henry stated that there are in North America about six small pines, including *Pinus Banksiana*, which have the faculty of producing cones at an early age and retaining them unopened and still containing germinable seed for thirty or forty years. Owing to their small stature these pines cannot contend with the lofty trees of the moist forest, but are confined to sites that are unsuitable for the latter. After a forest fire, however, the cones burst and the winged seeds are blown over the devastated area, where these little pines spring up in masses and replace the fine old forest, which can be restored naturally only after a long period of time. These fires are frequently caused by lightning.

The redwood forest is probably the finest in the world. The trees grow close together and attain enormous dimensions, a tree 360 feet in height having been measured, while a slide showed a huge log just felled, 15 feet in diameter. Only the Douglas fir and the two sequoias attain this vast height, and beat the famed eucalypti of Australia by about 100 feet. As regards volume, as much as 100,000 cubic feet per acre of merchantable timber has been measured in the redwood forest. I have lately measured some redwood trees up to 11 feet in girth, and 90 feet high, planted in 1856, in Windsor Great Park. This tree readily produces coppice shoots, after felling.

In Spain Dr. Henry saw the sole remaining tracts of *Abies Pinsapo*, to the north of Gibraltar. The trees can grow only on the north side of ranges of hills running east and west, and succumb to the sun and drought on any other aspect. In Corsica he saw the splendid forests of Corsican pine, which in the mountains of that country replace the silver-fir and beech forests of Central Europe and Italy. There is, however, a little silver-fir mixed with the pine. In Algeria there is very little cedar left, growing with *Quercus Mirbeckii*, a fine oak, the planting of which Dr. Henry recommends for Britain.

When we remember that the mountain forests of Great Britain and Ireland were destroyed during the glacial epoch,

and that we have only three indigenous conifers left—the Scots pine, yew and juniper—there must be a great advantage in planting the valuable conifers from the moist Pacific region of North America in our own moist regions. Those who have seen Murthly in Perthshire will at once perceive how splendidly these trees flourish there, though probably the best planted area in Great Britain is Ben More, near Dunoon, at the mouth of the Clyde. There, about thirty years ago, the late Mr. Duncan planted, at a vast expense, 2,200 acres of rough hills up to 800 feet altitude, chiefly with Douglas fir and *Thuja gigantea*. The plantations were laid out to form a scenic effect, designed by the painter Gustave Doré. The trees were planted 18 inches apart, and now form a magnificent pole forest with the tree vegetation of the Pacific Coast. There can be no doubt that any planter, after seeing these magnificent woods, will recognize the advisability of planting the bare hillsides of the Western Highlands, while our Welsh and Irish mountains might be similarly dealt with, and would render us for ever independent of imported coniferous timber.

Planting at Sulby Glen, Isle of Man.—Sulby Glen is famed for its beauty, in a beautiful island, but if the aspirations of the Arboricultural Society are fulfilled it will look even more charming in the future than it does at present. It was recently announced that the society had succeeded in acquiring an extensive tract of ground for the purpose of planting it with trees. The land is 46 acres in extent, and is situated on the northern face of the steep hill which slopes up to Mount Karran and frames in on the south the pretty glen. The soil seems excellent for the purpose, and the situation is sheltered from the winds, which prove most trying to tree life in Manxland. It has, in fact, almost the same aspect overlooking the northern plain as has Sky Hill, which, as is well known, is clothed with timber from base to summit, so there can be little doubt that this new site when planted will prove a success, and the growing trees before very long will add warmth and picturesqueness to an already beautiful landscape. The new plantation is situated on the farm of Ballacaley, and access is gained to it by the

by-road (once the main road to Ramsey) which winds its way from Gob-e-Volley to Old Sulby.

The commencement of planting operations was celebrated on April 15th by a little ceremony in which Lord and Lady Raglan took a leading part. His Excellency is warmly interested in the work of the Arboricultural Society in the Island, and responded readily to their invitation to plant the first tree.

The Times reports that two champion axemen and sawyers of Australia, H. Jackson and P. McClaren, who are exhibiting in London, working together with a double-handed saw, cut through a blue gum log 76 inches in circumference in 42 seconds. Their performance with axes was even more surprising.

Financial Statement of the Final Clearance of a Wood, 75—80 years old, in the North Riding of Yorkshire.—The wood, of 18 acres, was three miles from the nearest station, and the land not worth more than 7s. 6d. per acre for agricultural purposes. Directly it was cleared, in 1890—91, a crop of heather and gorse sprang up. Unfortunately there is no record available of the return from the thinnings, but the old woodman said that several hundreds of pounds' worth had been taken out for sale and estate use at different times.

In measuring the larch and Scots pine, an allowance was made for bark of $\frac{1}{4}$ inch in the quarter-girth on all trees girthing $8\frac{1}{2}$ inches and under, and $\frac{1}{2}$ inch on trees $8\frac{3}{4}$ inches and above. The oak was measured under bark, and the other hardwoods over bark.

Taking the cost of planting and fencing to be £8 per acre, then £8 at 4 per cent. compound interest for forty years equals £38 8s. To this add the rent at 7s. 6d. per acre per annum, accumulating at 4 per cent. per annum compound interest for eighty years, which amounts to £35 12s.: these together make £74, which is the debt per acre on the plantation at the final fall. Deduct this from £157 10s., the net receipts per acre, and there is left a profit of £88 10s. per acre for the whole

Larch and Scots Pine in Yorkshire. 215

period of eighty years, or £1 os. 10d. per acre per annum. In arriving at this, it has been assumed that plantations up to forty years of age will yield thinnings of sufficient value to pay labour incurred in repairing fences, thinning, &c., but will do little, if anything, towards reducing the outlay originally expended; and that after forty years of age, in addition to paying for labour, the thinnings ought at least to be of sufficient value to prevent further interest accumulating on the original outlay.

The timber was offered, standing, in four lots, by tender, and the highest offers were accepted. The timber afterwards was felled and measured by the vendor, and realised as follows:—

No. of Trees.	Kind.	Total cubic feet Contents.	Foot average.	Amount realised.	Price per ft.
1,328	Larch ...	50,770	38½	£ 2,674 18 8	1s. 0½d.
262	Scots Pine	3,520	13½	54 1 11	3½d.
74	Oak ...	891	12	33 19 9	9d.
116	Beech ...	3,448	29½	84 10 6	5½d.
35	Birch ...	431	12½	8 8 2	4½d.
12	Sycamore	327	27½	14 19 9	11d.
120	Ash ...	1,690	14	84 10 0	1s.
Four tons oak bark at 87s. 6d. per ton ...				17 10 0	
Fuel sold ...				17 15 6	
1,947 trees, 61,077 feet ...				2,990 14 3	
Less discount ...				73 13 5	
Add also timber used on the estate (395 feet larch and oak) at 1s. per foot. ...				2,917 0 10	
				17 19 0	
Deduct expenditure, as follows:—				2,934 19 10	
Actual cost of felling, harvesting oak bark, dressing and measuring the timber ...				£92 4 2	
Advertising, showing timber, and other petty expenses ...				7 11 10	
Total net receipts ...				£2,835 3 10	

It may be added that in 1898 the ground was replanted, chiefly with hardwoods.

W. B. HAVELOCK.

Honey Fungus on Cedar.—One of the numerous interesting sights which the members who attended the Royal English Arboricultural Society's excursion to Devonshire in August last were privileged to see was the magnificent avenue of Deodars on the Poltimore Estate. Their vigorous and healthy appearance was the occasion for much favourable comment. These specimens, we were told, were planted in the season 1851—52, which shows the remarkably suitable conditions for them to have attained their present height.

There are, however, several blanks; and standing about half-way up the avenue was a dead Cedar, which apparently had contracted a malignant disease in some form or another. The other missing trees, we were told, had met their fate in a similar manner. A good many reasons have been suggested as to the cause of death, amongst others, being root-fungus (*Trametes radiciperda*),* and honey-fungus (*Armillarea mellea*).

Mr. Slade, head gardener to Lord Poltimore, very kindly forwarded to me for investigation parts of the roots taken from the dead cedar, and on examining them closely I concluded that rhizomorphs of *A. mellea* were present. To be absolutely sure of this, I forwarded a portion of these roots to Mr. Robertson, Chatsworth, who agreed with me; and he, to make assurance doubly sure, sent the specimens to Dr. Somerville, who reported, "I find the rhizomorphs of *A. mellea* are present. Of course, this is not proof positive that this fungus has killed the tree, but it is strong presumptive evidence."

Seeing there was every reason to believe that this was so, in taking preventive measures to check the disease, in order to endeavour to save the adjoining trees from being attacked and meeting a similar fate, I advocated trenching round the infected area, digging up and burning all the roots of the dead Cedar, and scattering gas-lime over the ground so trenched.

* *T. radiciperda* is now known as *Fomes annosus*, Fries., and Honey-fungus, *Agaricus melleus*, as *Armillarea mellea*, Vahl.—ED.

This parasite is found often in isolated places, but more frequently in young plantations where a young crop of conifers succeed a crop of broadleaved species, especially beech. The dark-brown mycelial threads that extend themselves through the soil, sometimes to a considerable distance, penetrate the bark of the roots with which they come in contact, and develop themselves under it as long, white filaments, ultimately causing the death of trees of almost any age, but chiefly young plants of from five to ten years old. The first evidence it shows of its presence is that the infected trees turn a yellowish colour, droop their needles, and rapidly expire. The base of the stem becomes swelled to almost twice its natural size; there is a copious outflow of resin, which cements the soil at the foot of the tree. In the autumn, fructification takes place, and numerous honey-coloured mushrooms make their appearance round the base of the stem. The disease is most prevalent in wet seasons, being most noticeable in spring and autumn.

It appears in patches here and there in young plantations, sometimes in a dozen different places. I have seen a plantation practically ruined by this dread disease; it spread with such rapidity, and appeared in so many places, that it was useless to attempt checking its progress.

The only prevention for its spreading is to isolate the infected area by digging a trench all round, about 18 inches deep, and scattering gas-lime among the soil filled in; but where the fungus appears in several places this is almost impossible.

It is imperative to dig up all the infected trees, or rather all coniferous trees in the infected area, and burn them; then fill the vacancies with broad-leaved species.

HURSLEY PARK, Feb., 1907.

R. L. ANDERSON.

Sale by Auction of Oak Timber in North Lincolnshire.—The timber was felled and peeled in the Spring of 1906, rounded and dragged into lots, containing about 80 cubic feet each, on an average, and offered for sale by public auction on August 1, 1906. The ash and other timber had been felled during the preceding winter. The crop was thin and quite ready for clearing off. Most of the oaks

were from stools, and though sound and practically free from "shake," yet many of the butt-ends showed traces of the old stools. The timber cost at least $1\frac{3}{4}d.$ per foot to cart to the nearest station, which, of course, would have to be borne by the purchasers.

It may be added that the ground, which is of a sandy nature, has just been replanted with mixed hardwoods and larch.

No of Lots.	No. of Trees.	Kinds of Trees.	Cubic feet.	Average size per tree.	Amount realised.	Price per cub. ft.
93	670	Oak	7,610	$11\frac{1}{4}$ cub. ft.	£ 436	s. 7
11	102	Ash	625	$6\frac{1}{2}$ "	7 6	1 1 $\frac{1}{2}$
1	4	Lime	43	$10\frac{1}{2}$ "	33 5	0 1
1	2	Larch	53	$26\frac{1}{2}$ "	1 15	0 7 $\frac{1}{2}$
3	121	Poles	32		3 15	1 5
					1 6	0
109	899		8,363		476 8 6	
Add $56\frac{1}{2}$ tons of bark at 60/- per ton, less 5 per cent.					161 0 6	
Add timber reserved for estate use					51 13 4	
Add fuel, &c., sold					15 8 11	
					£704 11 3	

Area of the land cleared, $7\frac{3}{4}$ acres.

In August, 1905 (the preceding year) the adjoining area was felled, and sold in the same way. The oak averaged $16\frac{1}{2}$ cubic feet per tree, and made only $11\frac{1}{2}d.$ per foot, or a difference of $2\frac{1}{4}d.$ per foot.

W. B. HAVELOCK.

Obituary.

The Hon. Mark Rolle died at Argeles, in France, on May 1st, at the age of 72, of congestion of the lungs. He was always a great lover of trees, and members of the Royal English Arboricultural Society who visited Bicton last summer and experienced his great hospitality, as well as all the members of the Society, to which he presented a fine collection of conifers, now at Tubney, near Oxford, have good reason to revere his memory.

We have also to report the death of Geheimrat Karl Gayer, formerly Professor of Forestry at Munich, at the advanced age of 85. His works on silviculture and forest utilisation are well known, and he was the first to attack the shelter-wood compartment system for silver-fir, spruce and beech, and to substitute for it the group system, which is now successfully practised in Baden and Bavaria. He was also a strong advocate for mixed as opposed to pure woods.

Just as this number was completed, the regretted deaths of Sir Dietrich Brandis, K.C.I.E., F.R.S., and of Mr. L. Boppe, C.I.E., Directeur Honoraire of the Nancy Forest School, were announced; also of Dr. Maxwell T. Masters, F.L.S., and of Mr. P. Baylis, Deputy Surveyor of the Forest of Dean. Notices of their work will be given in the Michaelmas Number.

Original Articles.

PROPOSED CONVERSION OF UNDERWOOD INTO HIGH FOREST.

LANDED proprietors in the southern counties of England are faced with a problem, which admits of no other solution but a sweeping reform; the abandonment of the old system of underwood cropping of their woods for the more modern methods of high forest.

Years ago, underwood was a very remunerative source of revenue, in fact, any other system than coppice-with-standards was undreamt of so long as the demand for underwood continued. Gradually, however, the demand decreased; not through any depreciation in the quality of the crops, but through other causes beyond the control of estate owners. Chiefly amongst these was the discarding by bakers of wood-ovens for the more up-to-date and convenient steam-ovens. Where one baker used to buy 5,000 faggots annually years ago, he now requires from 150 to 200, merely for lighting up.

This decrease in the demand for faggots naturally led to a reduction in the price, and to such an extent, that they not much more than cover the cost of cutting, making-up, and carting.

220 Conversion of Underwood into High Forest.

Twenty to thirty years ago prices for faggots ranged from 23s. to 26s. per 100, whereas at the present time they realise only the insignificant price of 10s. to 12s. per 100.

Another cause which has had a disastrous effect is the monopoly of the hoop trade by the foreigner. Although there still remains a market for home stuff, the price is so low that dealers in this country have given up hoopwood.

Again, there used to be a much larger demand for hurdles for folding sheep. The decreased demand is easily accounted for; there is not one quarter the number of sheep in the country now that there were years ago. Where one farmer used to keep 1,000 sheep we now find only about 100, and in numerous instances even fewer, while, also, galvanised wire-netting has displaced hurdles to a large extent.

Apart from commercial requirements, wood was utilised for domestic purposes to a much larger extent, but since the introduction of closed ranges in place of open grates in nearly every household, coal is a much more convenient article of consumption than wood.

The wood-dealers are continually complaining, and rightly so, of the scarcity of labour, they having a great difficulty in finding experienced men to cut and work up the wood. The younger generation evidently consider country life very degrading, as they seem to prefer the inducements offered by a town, to the much healthier occupation of working in a wood; at any rate, the fact remains, young men will not take to the work.

Numerous other causes could be cited, of more or less importance, in explaining the depreciation of underwood, but I consider these sufficient to demonstrate the utter uselessness of continuing on the same lines in the future as has been done in the past.

On this estate, during the present season, it was considered necessary to cut over 100 acres of coppice. Although a great part of it was overripe, yet most of it was of excellent quality, and fairly well cropped. The price realised, about £40 for 100 acres, was so insignificant, that had it not been for the necessity of having it cut, I doubt if one quarter of it would have been sold. However, it is no use leaving it until another

season, in the hope of getting a better price, as the same thing would occur, and on an estate where upwards of 3,000 acres of underwood require cutting in rotation, one cannot work systematically unless a large area is cleared annually.

On neighbouring estates the same thing occurred—abundance of underwood, but no demand. On one large estate, within twenty miles of this, where formerly the annual cuttings realised upwards of £600, this year's clearing made only about £160, and this in a district where one would think there were good prospects of a ready market for faggots, poles, &c.; but, as in other places, the supply considerably exceeds the demand, consequently prices rule very low.

In order to remedy this existing state of affairs, on the Hursley estate, a policy of systematically clearing the ground of coppice, and its subsequent conversion to high forest, has been resorted to. On different parts of the estate there are large areas enclosed and replanted every year, the planting being done on the most approved modern lines. Although requiring a considerable time, and involving a large outlay, yet after a few years there will be a complete transformation, which will reflect upon the owner considerable credit for the wisdom and forethought he displayed in dealing successfully with such a formidable subject.

Considering the alarming increase in our imports of timber, and rapidly diminishing sources of supply, I think that proprietors, who have the interests of their country and estate at heart, would do well to follow on the same lines, to the material benefit of their descendants and of the nation at large.

HURSLEY PARK, Feb., 1907.

R. L. ANDERSON.

THE MISMANAGEMENT OF QUICK FENCES IN ENGLAND.

THE so-called depression in agriculture of the last thirty years was severely felt, first, by the farm-tenant, and subsequently, by the owner, both of whom in many instances have disappeared to make room for others. It has left its chief mark on the land in the dilapidated condition of the fences and drains.

In the early part of the last century, when the cultivation of wheat and other cereals was very remunerative, not only were many acres of pasture and waste converted to arable land, but many thousands of miles of straight and clean quick fences were planted, and a still larger number of miles of under-drains laid.

When corn prices first dropped, with a landlord naturally unwilling to realise the fact, and persuading himself that the fall was a temporary one, the first resource of the tenant with an adverse balance sheet was to economise his labour, and neglect the fences and ditches. This state of things to a great extent still continues, but not entirely for the same reasons. Landlords and tenants have now got accustomed to a more "go-as-you-please" style of things; large ragged fences are supposed to conduce to partridge breeding and driving, the old fence-hands have died off and no new men have taken their place, and few landlords, farmers, or agents are able and willing to take the necessary pains to teach them.

It is contended by some agriculturists that quick fences, or in fact, any fencing, is unnecessary between arable fields, that such fences impede the ploughing, occupy ground, and, to some extent, harbour vermin, but there must always be fences between arable and pasture and by the sides of roads and woodlands, and even supposing that the England of the future will consist of pastures and market-gardens, fences for shelter will be the more necessary.

At present on lands where the fences are neglected, the usual plan is for the tenant to obtain a supply of poles and "battens" from the estate woods, and insert them in the gaps with the aid of a few nails; there is no harm in this system, but its appearance had better not be described. In default of the larch pole, the farmer turns his attention to his biggest fence, cuts it down, and distributing the fragments along his other fences, jams them into any objectionable gaps, and goes his way. The result of this plan is not objectionable to the observer at any rate in the winter, but as soon as the spring shoots commence putting forth their tender leaves, they are "whipped" off or choked by the "dead fence" so inserted, and the living fence makes no progress, but, on the contrary,

dies further back, leaving a hole to be still more substantially filled in due course.

There is a third way of repair that is sometimes necessary but should not be adopted if any other means can be devised, and under no circumstances in a hunting country, the plain or the barbed wire. This is bad enough as a simple and visible fence, but intertwined with quick is a most dangerous trap for the unwary horseman.

The tenant-farmer in England from long custom and now to some extent by law has security of tenure, provided he carries on his farm according to the principles of good husbandry, but the question of good husbandry arises more on the condition of the fences than perhaps on any other point.

The tenant has a right to argue, if he wishes, in this way, saying: "I am bound to keep my fences in good order. In the absence of a record of the holding, what is good order? I shall do as little repair as I reasonably can, the amount of which will be regulated by the knowledge and attention of my landlord or his agent. After all, it is not really my affair, these fences are not my property, I may not be here a few years hence. The more I can manage to economise on my fences the more capital I can put by for a rainy day, or for a bigger farm."

I cannot help thinking that the proper course for the smaller owners of land is, in future, to keep a trained staff of men for the fences, and control them themselves. If once brought back to decent order the after-maintenance is comparatively simple. This responsibility on the larger estates might be confined to woods and roadway fences, but on the smaller ones all fences might be kept up by the landlord. It is obvious that in every fresh agreement a certain pre-arranged sum should be paid by the tenant for these repairs. This should be apart from the question of rent, since if the sum were added to the agreed rent, it would affect the poor-rates assessment.

With hardly an exception one hears the same complaint: "I have not a man on the place who knows how to lay a fence, nor who cares to learn." In fact, why should he? The matter does not lie with the labourer, it concerns first the

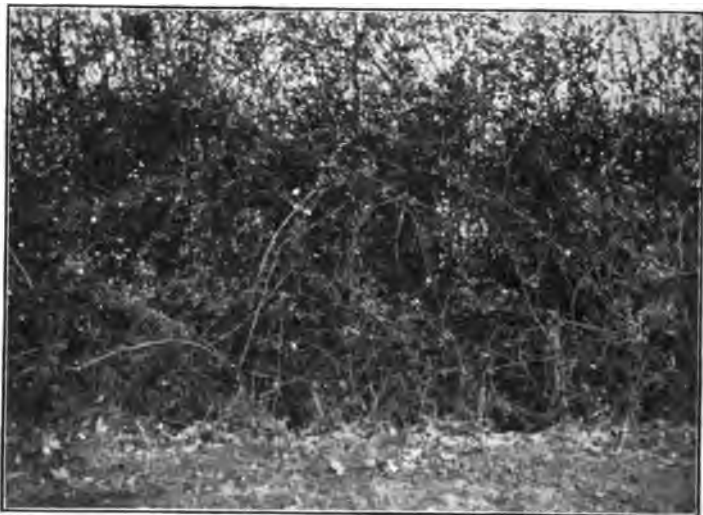
tenant, and eventually the owner. A man who becomes a skilled hand at this work should certainly receive at least 10 per cent. increase of wages while performing it. If the men knew this they would become more willing to learn, but it must be the more educated farmer who must first master the proper methods, and his man, with watchful instruction and practice, will soon acquire the skill. This skill is one of the things most difficult to inculcate by County Council classes, or evening lectures; it can be discussed and explained on the field only.

It is therefore for the purpose of arousing interest in this subject that this article is written, and I trust that the photographs I have taken, by their variety of bad and good, may be somewhat more explicit than the woodcuts in the hitherto published notes on the subject.

It may perhaps be well in this article to state shortly the best manner of laying or layering fences. In the first place all weeds, such as elder, honeysuckle, briars, ash and other seedlings should be removed. This should always be done, since whatever may be the treatment of the fence it is absolutely necessary that it should be properly cleaned. The injury done to quick fences in the past has been mainly caused by suffocation due to these plants. Elder perhaps is the chief offender, and requires constant eradication, since the seeds are so readily carried by birds.

After the fence has been cleaned it is desirable to draw in the gaps such young quick as may be available, so that the fence may be proof against stock. The next step would be to trim up or forebush one side of the fence, preferably that on which lies the arable land, and then it may be well to wait for a year or more till the quick is recovered and the spaces previously occupied by weed plants approximately filled in. In some cases, of course, this preparatory treatment may be necessary in part only, and then the process of laying can be commenced.

The first step the woodman takes is to cut out carefully the coarser and knotted wood, and, of course, all dead wood, leaving perhaps a certain number of upright rods to which the layer fence is to be attached. The drawback of leaving rods is that



No. 1.



No. 2.

their vitality being greater than that of the layers, they throw a bigger shoot in the spring and summer, and make the fence uneven. This may be remedied by nicking in the same manner as the layers, so as to check the greater growth. It is absolutely necessary in cutting down fences that the upstroke should be invariably used. The effect of the downstroke is almost invariably to split and splinter the stunt, so that it cannot shoot out again except at some distance below the cut. The wet, of course, readily enters, and produces a certain amount of rotten wood. If the wood is cut with an upward stroke the water can run off easily and little or no decay takes place. When nicking the layers, an upward and downward stroke may be used, cutting out a small wedge, but this does not seem to be essential; a single upstroke is simpler and quite as efficacious. The layers are then braided against the living uprights and the dead stakes, which should be put in at intervals of about 2 feet.

Practically all fences should be braided over. Even young fences, although they may look well to the eye, are not impervious, since the vertical stems more or less readily open out to pressure. When braided down the different plants are more or less horizontal, and will consequently withstand such pressure. In selecting stakes (which should average about 2 inches in diameter), the nature and quality is immaterial, since it may be even desirable that they should rot off in the course of three or four years, and thus make way for the living fence. It is important, however, that the lower 18 inches should be barked, so that there is no possibility of the stakes growing. No more stakes should be used than is absolutely necessary, since the dead stakes to some extent prevent the growth of the quick, and, wherever the young shoots of the fence are moved by the wind, they are liable to whip against the stakes, which necessarily injures them. The stakes having been driven in, the young branches or layers are braided or interwoven about them.

Up to the present time it has been the custom to tie down into place the upper layers with osier bands. This, of course, is unsatisfactory, since the osier has not sufficient lasting capacity to restrain the fence, and would invariably be nipped or pulled off and eaten by any stock that could

gain access. A rather better plan is to interweave a certain number of thin rods, or brash, about the top of the stakes, and thus prevent the layers from springing up; these are sometimes called binder rods. This course is more efficacious than willow bands, but it is unsatisfactory since it prevents the proper growth of the top of the fence and spoils its shape. Some twelve years ago we adopted on this estate the system of tying with wire.

Tying with wire was first recommended to me twelve years since by my overseer, who has the rare virtue in agriculture, originality, and we have unintermittently used this material ever since with complete satisfaction; it was also recommended by the Board of Agriculture in its monthly journal some eighteen months since, and is used in Yorkshire.

Whether the journal has been misunderstood I know not, but a letter a short time since in "Country Life" implored its readers not to use wire, apparently thinking that such wire as No. 8 or 10, which is most pernicious, was used to run through the fence.

The wire that should be used is commonly known as tie-wire, about No. 20, and should be not more in diameter than stationer's packthread, or, say, the lead of an ordinary cedar pencil.

The practice on this estate is as far as possible to use up the wire bought for tying faggots, this being far cheaper and more convenient than the ancient willow band.

When new wire is bought in the roll, as is all wire, the roll need only be divided in one place, the diameter of 24 inches being the convenient length for one faggot.

Ordinarily, a 12-inch length is enough to tie with; this is more than is wanted for the controlling of the branches, but some 2 or 3 inches must be left so it can be held by the gloved hand of the fencer. The wire need not be made use of in braiding, except occasionally, but instead of the dead boughs, the living tops should be tied to the stakes as hereafter shown. The wire, instead of being knotted with bonds, &c., which is a slow process, is simply twisted two or three times, this being much more expeditious and surer.

A horse failing to jump a braided or layered fence would



No. 3.



No. 4.



No. 5.



No. 6.

simply break away the quick, as the wire is far too weak to hold it under such circumstances, and the horse could not possibly be injured.

A fence so repaired may remain serviceable for ten or fifteen years, but after this time it naturally becomes full of gaps, and has to undergo the process of relaying. Naturally the proper plan is to keep these fences trimmed yearly, and it is not clear that this is a more expensive system in the long run than intermittent repair, with the loss and damage that may accrue to crops from cattle breaking through. The general height for quick fences may be put at 3 feet 6 inches, but in future it would be desirable that more discrimination should be used. In the first place, between two arable fields a fence can scarcely be considered necessary, and the lower it is kept the better; but where fences border pasture land, a fence should be kept as high as possible, that is, as high as a man can reach to trim it, because such a fence is serviceable for shelter for the stock, both from the winds of the north and east, and on the south from the sun.

This fence (No. 1) is an instance of simple neglect. It is about fifty years old, and has not been touched for twenty-five years; the ivy is slowly killing the quick, and the brambles are more rapidly assisting in the process. There may be underdrains leading into the ditch, but this at present cannot be ascertained. A fence like this on arable land is doing much harm, the seeds of both quick and bramble are eaten by birds and sown into the cultivated land, and I have seen in Essex whole fields sown down in this manner, and producing a thick undergrowth. The land is not cultivated, though good in quality, and is covert for game only.

A fence of this nature is comparatively innocuous on pasture, since it does not to the same extent sow down the adjoining land, and it is a good shelter for stock, from the cold in winter and the sun in summer. Let us hope that the money that should have been spent in its maintenance has been used for some useful purpose.

The proper course here is to clean out all brambles and ivy as far as practicable, forebush or trim up the sides so as to obtain side-shoots—if on pasture, so as to maintain shelter; if

on arable, after cleaning it, the thicker stems should be cut out, the younger ones braided down, as shown hereafter.

No. 2 shows a very different form of mismanagement. It is a very old fence and has once been layered, and apparently trimmed every year, while a considerable amount of money has no doubt been spent upon it; yet it is unserviceable and ugly.

One supposes that for years the occupier has said to his men, on a wet harvest day, "You had better go fence-trimming," and he has then gone home. The men have gone out and trimmed the quick, elder, brambles, &c., anything that came in their way, without instructions, without a thought as to whether their labour was well-directed or not.

When the time comes that something must be done in the shape of "repair," foreign deal is bought with the maximum of expenditure in sawing, pointing, and nails, and we have a fence that is unsightly and unserviceable.

No. 3 fence (if it can be so called) resembles the last, so far as the pitiful yearly trimming is concerned. Years since a bird-dropped seed produced the elder shown here. No notice was taken of its advent, no thought that it should be rooted out as a noxious weed. As it grew rapidly, the yearly trimming caused a stronger side-growth, which surely drives back and kills the adjoining quick, and thus ruins the fence.

This fence has been layered years since, but it now would require a clever workman to repeat the process to much purpose.

No. 4 is a pitiable fence, patched up, and possibly stock-proof. All that can be said in praise of the owner is that it has not been trimmed; the younger shoots can be readily braided down into a very fair fence, and the iron hurdle used to strengthen an unusually weak place.

Unless there is a large supply of unsaleable poles on an estate, the iron hurdle is preferable to the pole as a means of temporary repair, and is certainly cheaper than the sawn "batten." It allows the freer growth of the repaired quick fence, and can be carried easily by the workman from place to place, year after year, wherever a fence requires protection.

No. 5 has been taken in hand for repair; it has been allowed to grow for three years without trimming; the brambles



No. 7.



No. 8.



No. 9.



No. 10.

have just been rooted out, leaving the openings, and lie on the ground the other side of the fence. It is now ready for staking, braiding down, and tying in with wire.

No. 6 fence was a mass of brambles three years since ; it was cleaned and the straggling lower branches cut back or braided over the gaps left by the brambles. The fence is now thickening, and it can now be braided down, or as it is the north fence of a meadow, it may be preferable to keep it high, but care must be taken that the upper branches are kept trimmed, so that they do not overshadow the lower ones, which deprived of light and air would die back, again forming gaps through which the north wind can enter, and stock escape.

No. 7 shows the process of braiding down. The men should have leather gaiters and hedging-gloves. A good coat can be made of an ordinary corn-sack, as in the picture. It should be worn over the ordinary clothes, and is warm, serviceable, and cheap.

No. 8 shows the process of tying the upper branches to the upright dead stakes with wire, no bonds or binder rods being used.

No. 9 has been repaired long ago, and has been kept trimmed for fifteen or so years.

The layered wood is plainly seen ; it has now one year's growth of shoots and requires switching, or trimming.

No. 10 is now in good order, but it is clear that at one time there must have been large gaps, which apparently required a long batten to prevent the passage of stock, &c., and that is plainly seen ; it might be now safely drawn out and burnt. This is a good instance of what can be done to arrest the mismanagement of quick fences.

E. R. PRATT.

THE LIFE-HISTORY OF THE BEECH.

Awarded Gold Medal.

INTRODUCTION.

FEW species have undergone such vicissitudes in popular favour as the Beech. Evelyn had but a poor opinion of it as a timber tree, and his view was echoed by Gilpin a century later. "Some indeed," he writes in 1791, "rank the beech among timber trees; but, I believe, in general it does not find that respect, as its wood is of a soft spongy nature, sappy and alluring to the worm."* There can be no gainsaying this liability to the attacks of the larvæ of *Anobium*; but, looking at this species less as a source of timber itself than as an aid in the cultivation of other kinds of trees which produce more valuable timber, modern opinion takes a different view. Thus Professor Gayer writes:—"There are many places in which beech will continue to be a valuable wood from a financial point of view; but, where this may not be the case, it will still have its unsurpassed sylvicultural value; for without the beech properly managed forests of broadleaved species would be impossible, since with it a good many other valuable timber trees which can only be grown with its aid would have to be given up."† "In the earliest times," writes Dr. Nisbet, "it formed large pure forests on the calcareous and chalky soils throughout central and southern England, attaining its finest dimensions in Buckinghamshire and Hants, but was not indigenous in Ireland or Scotland, where it was introduced early in the eighteenth century. It is grown on the Continent in pure forests over enormous areas on account of its fine quality as fuel. In Britain, there exists no such reason for its cultivation on a scale relatively so extensive, and as its timber is less remunerative than that of other high forest growth, it must claim attention chiefly on account of its soil-protecting and soil-improving qualities, and as a ruling species in admixture with which large timber trees of the more profitable broadleaved species can most remuneratively be grown without

* "Forest Scenery," vol. i., p. 50.

† "Der Waldbau," 3rd ed. (1889), p. 448.

danger of the soil deteriorating through any interruption of the leaf-canopy, and the insolation consequent thereon.”*

We shall be speaking later on of this soil-improving quality when dealing with the structural and physiological characters of the root of this species; so, not to multiply authorities, we will add only the opinion of Professor Ney. “The beech,” he writes, “which in pure forest is ranked among more valuable species only because of its protection of the productive capacity of the soil, is of extraordinary value in mixed forest owing to the dense shade it casts over the ground and to the improvement of the soil by its heavy fall of leaves. When beech is judiciously mixed with them, all kinds of timber trees exhibit greater energy of growth than when alone. The beech protects the productive capacity of the soil better than any other species of tree, and therefore well deserves its name of ‘the Mother of the Forest.’”†

A careful study of the life-history of this species is, therefore, obviously a matter of moment to the modern forester. We propose to follow the order of development from the seed and its germination to the ripening and shedding of the fruit; but shall reserve all detailed account of fungoid and insect enemies for the concluding portion of the paper. It must also be borne in mind that we are here concerned with the history of the individual tree rather than with its silvicultural treatment or its utilisation.

THE SEED AND ITS GERMINATION.

The beech begins to fruit regularly, producing enough beech-mast or nuts to reproduce a crop of trees, when about sixty or seventy years of age. The production of fruit in large quantities depends upon the partial isolation of the fully-grown trees, which admits light and air to their crowns and favours the development of flower-buds. Seed-years are foretold by the thickening of the flower-buds in the previous autumn; but good years do not occur oftener than every three, four, five or six years. The fruit ripens in October, when the dry hook-armed “Involucre,” or husk, splits downwards into four recurving

* “British Forest Trees” (1893), p. 156.

† “Die Lehre vom Waldbau” (1885), p. 93.

segments and drops its two, or less commonly three or four, triangular glossy-brown nuts. These nuts are largely eaten by squirrels, mice, voles, dormice, badgers, swine, pigeons, thrushes, blackbirds, fieldfares, pheasants, &c.; but in a natural state there are generally plenty of seeds hidden among the fallen leaves or adhering to the protective husks to furnish a sufficient crop of seedlings. Lord Avebury suggests* that the nuts are adapted for carriage from the parent tree by squirrels, and contrasts them, from this point of view, with those of the Hornbeam. The latter, he points out, being designed for wind-dispersal, are smaller, harder, and winged. The nuts, without the husks, may be reckoned at 6 to the grain, 170 to the ounce, or 2,720 to the pound;† and 50 per cent. may be considered a satisfactory proportion in germination.‡ Professors Emil Wolff and Knop give§ the approximate composition of two beech-mast cakes, (a) with, and (b) without the shells, as follows:—

	a.	b.
Water	10	12.5
Organic Matter :		
Albuminoids	24.0	37.3
Carbon hydrates, &c.	31.3	36.9
Crude fibre	20.5	5.5
Fat, &c.	7.5	7.5
	<hr/> 83.3	<hr/> 87.2
Ash	5.2	7.7
	<hr/> 98.5	<hr/> 107.4

The former professor gives the composition of beech-mast when air-dry : as water 18.0 per cent.; ash 2.71; potash .62; soda .27; magnesia .31; lime .67; phosphorus pentoxide .56; sulphur trioxide .06; silica .05; chlorine .01;|| whilst the ash

* "Notes on the Life-History of British Flowering Plants" (1905), p. 366.

† "E. J. C. Brace, "Forestry," vol. vii. (1883), p. 435.

‡ Dr. John Nisbet, "British Forest Trees" (1893), p. 160.

§ "Agricoltura-Chemie" (1868), p. 720.

|| Emil Wolff, "Mittlere Zusammensetzung der Asche aller land-und forstwirthschaftlich wichtigen Stoffe," 1865.

he gives as potash 22·8; soda 10·0; magnesia 11·6; lime 24·5; phosphorus pentoxide 20·8; sulphur 2·2; silica 1·9; chlorine 0·5. The high proportion of albuminoids indicates at once the importance of the food-store to the plant itself and its food-value to the many animals that appropriate it. The nuts yield from 10 to 20 per cent. of their weight of a bland non-drying oil, with a specific gravity of 0·9225, which is much valued in France. Its presence may be the reason why the seed seldom retains its germinating power beyond the spring following the autumn in which it ripens, and not always till then. As, to avoid its many animal foes in their winter-hunger, spring sowing is often desirable, the nuts must be stored in a cool, airy place, turned frequently to avoid the danger of becoming heated on the one hand, and covered with straw to protect them from frost on the other.

Just as the triangular section of the nuts adapts them to pack closely, two or three together, into one husk or cupule, so the sinuously-folded "cotyledons" or seed-leaves of a single seed fill the greater part of the interior of the nut; since, though the immature ovaries are three-chambered, each chamber containing two ovules or immature seeds, only one of the six reaches maturity. The merest vestiges of the other five are discernible, for the most part, near the apex of the seed, *i.e.*, in the apex of the fruit, though on rare occasions two or three seeds may be developed in a single fruit. The ovule is suspended from the upper end of the ovarian chamber, and is bent back on itself ("anatropous"), so as to bring its minute apical opening ("micropyle") near to the lower end of the stylar canal, down which the pollen-tube passes before fertilisation. This micropyle persists in the seed, and is the aperture through which the "radicle," or embryonic root, leaves the seed in germination.

Whilst the seed nearly fills the cavity of the fruit, it has, when ripe, no store of food external to the embryo itself, such as is often present, as, for example, in the grain of corn: it is, to speak technically, "exalbuminous." This merely implies that the fairly copious supply is stored mainly in the folded cotyledons. So repeatedly are these folded that they are relatively large and rather thin.

Germination takes place generally in May, as the combined result of the warmth and moisture of spring, and is preceded by the softening and swelling of the nut and the absorption not only of water but of atmospheric oxygen. A rise of temperature, consequent on the rapid chemical changes in progress within, can be experimentally detected in a number of seeds beginning to sprout. The radicle then pierces its way through the end of the softened coat of the nut, and, whatever may be the position of the nut, on, or in, the soil, it takes a direction vertically downward, thus pulling the nut into the horizontal. Lateral branches are speedily given out by this radicle, at first near the point at which it emerges from the nut, and then in regular succession from points nearer to its downward apex. Each of these lateral roots may be observed to have forced its way through the outer tissues of the parent root, so as to be surrounded at its base by a slight torn ring ("coleorhiza"): these secondary roots are, in fact, what is termed "endogenous," or deep-seated in origin. They generally grow so vigorously as soon to equal the parent root in size. Just above the point at which the radicle leaves the nut, a slender stem-structure, the "tigellus," or "hypocotyledonary axis," next pulls itself by its elongation out of the nut, rising vertically in a loop bent sharply upon itself. It drags after it the cotyledons, shaped and folded like two fans, and as their removal empties the parent nut, its coat ("pericarp") now soon becomes detached. Even before emerging from the nut the cotyledons have begun to form their green colouring-matter, or "chlorophyll," especially towards the surface, which will become, when unfolded, the upper one: three principal veins have appeared in each of them, and their under surfaces have developed a white shaggy covering of hairs. Such a method of germination, in which, instead of remaining underground within the seed as a mere food-store, the cotyledons are exposed and become green so as to manufacture additional food from the carbon-dioxide of the atmosphere, is termed "epigeal." The obtuse, fan-shaped cotyledons, unlike as they are both in form and in texture to the subsequently-developed foliage-leaves, may be to some extent ancestral, or "vestigial," like the so-called "juvenile" or primordial foliage of coniferous seedlings;

but probably their form is mainly an adaptation to their folding in the seed, and their texture may be dependent upon their own surrounding conditions. They soon become somewhat leathery in texture, and this, and the felted under-surface, may be protections against the radiated cold of a season when frosts on the ground are frequent. "Late frosts in spring," says Dr. Nisbet,* "and the scorching mid-day sun in summer, though both mitigated by shelter from the parent trees, are injurious to the seedlings, which break into leaf just when the greatest danger from frost may be apprehended. Late frosts are less to be feared on the higher-lying tracts and uplands, and on the cool northern and eastern exposures, where seed is later in germinating." The absence of the pointed apex, or perhaps, rather, its presence in the foliage-leaves, possibly may be connected with the greater liability of the latter to the drip of overlying leaves; whilst with equal hesitancy would we refer to the fact that the upper surface of the cotyledons often assumes a dark chrome green, which resembles—perhaps protectively—the hue of surrounding mosses. Occasionally, as in the oak, three cotyledons are developed.†

If growing in ground infected in the previous year, or if kept too moist during the earliest stages of germination, beech seedlings are peculiarly subject to the fatal attacks of the fungoid disease *Phytophthora omnivora*, De Bary (*P. Fagi*, R. Hartig), known generally as "damping-off." This fungus and its attacks will be dealt with in the sequel.

THE ROOT AND ITS SOIL-REQUIREMENTS.

The roots of the beech seldom penetrate very deeply into the soil, a circumstance which enables it to flourish in association with other species, such as the oak, which are more deep-rooted. The roots at all stages branch freely and extend for a considerable distance horizontally, especially when the soil is rich in humus. Though fairly accommodating in the matter of soil and subsoil, the beech certainly prefers a rich calcareous loam, without stagnant water, but sufficiently porous

* Dr. John Nisbet, "British Forest Trees," p. 161.

† Reinsch, "Ueber das Vorkommen von drei Kotyledonen bei *Fagus sylvatica*": "Flora," 1860, p. 721.

to yield a moderate supply of moisture and to maintain warm conditions for the roots. "Mild loams, clayey marls, and loamy limes, no matter of what geognostic origin, are," says Dr. Nisbet,* "those which suit it best, although fresh sandy soils, especially with a loamy or marly subsoil, and the better varieties of loam often found on the uplands, also induce good growth and development, more particularly when the atmosphere is humid. Pure limy† and sandy soils are alike unsuited for the beech. . . . By means of its thick fall of leaves, it makes a natural effort to provide the soil with a good non-conducting cover for the preservation of the soil-moisture during the heat of summer, and on decomposing, this yields a rich variety of humus or mould, which modifies and improves all classes of soil with respect to their physical properties. Though it extracts a considerable amount of mineral nourishment from the soil, it replaces this again by the humus formed from the fallen leaves, for most of the mineral matter is left in the foliage during the natural process of assimilation. It is, therefore, by no means an exhausting forest crop; it is, on the contrary, on good soils certainly an improving one." Professor Ebermayer found that the soil under beech is always much poorer in carbon-dioxide than that of fallow land or under spruce, and he attributes this fact to the thorough aëration of the soil by the numerous rootlets of the beech. "The roots of the beech," he writes,‡ "mostly ramify at a small depth through the upper layers of the soil, which are rich in humus. The absorbing portions of these rootlets are generally not furnished with root-hairs, but are covered with a fungus (*Mycorrhiza*), which acts as a go-between as to water and food-supplies, and by means of which the trees obtain much more nourishment from these humous soils than they could from mineral soil by means of root-hairs. A most valuable character of the beech is that by its much-branched roots it keeps the soil more open or porous than does the spruce. To this character, combined with the fact that it is a shadebearing

* Dr. John Nisbet, "British Forest Trees," pp. 158-9.

† Pure lime soils are non-existent; by pure sandy soils Nisbet probably means pure silicious soils, also non-existent.—EDITOR.

‡ Ebermayer, "Forstlich-naturwissenschaftliche Zeitschrift" (1893), p. 237.

species, and yields a more nutritious and more readily decomposable humus than conifers, the beech owes its soil-improving capacity and its great importance for mixed forest."

There is at the present time a certain amount of difference of opinion as to the precise *modus operandi* and as to the necessity of this *Mycorrhiza*. Frank suggested that it absorbs not only water but organic matter, both nitrogenous and non-nitrogenous, from the soil, and hands it on to the rootlets whose root-hairs it replaces, at the same time obtaining some nourishment itself from the outer tissues of the root, so that the association is one of mutual benefit or *symbiosis*. Such mycorrhizas are general on allied genera, such as oaks and chestnuts: experiments with some other plants seem to indicate that their growth is distinctly favoured by the presence of mycorrhizas; and the failure of attempts to rear beech seedlings in nutrient water-cultures suggest that in this species they may be essential.* More recent researches as to the nutrition of lichen-forming fungi and of *Rhizobium*, which forms the tubercles on the roots of the *Leguminosæ*, suggest the possibility that these mycorrhizas may even enable the tree to utilise some of the free nitrogen of the atmosphere. To what kind of fungus the thread-like filaments or "mycelium" of the mycorrhiza may belong has not yet been ascertained.

In internal structure, the root of the beech closely resembles that of many other dicotyledons, especially its near ally the oak. A transverse section across a young root, or near the apex, *i.e.*, in the young portion, of an older one, shows a wide outer marginal region, the *cortex*, made up of rounded somewhat loosely arranged cells, with spaces between them, appearing, when magnified, considerably larger than those in the central region, the *stele* or axis cylinder. At the apex itself, beneath the mycorrhizal investment, a section (Fig. 1) will exhibit a more or less loose sheath of cells, the *pileorrhiza* or root-cap, the outer layers of which are dead and sloughing away, though internally there are moist living cells in organic continuity with others, all alike minute, which extend to the centre. Here then, a little behind the apex of root or rootlet,

* Lord Avebury, "Notes on the Life-history of British Flowering Plants," p. 371.

is its growing-point or "punctum vegetationis," composed of a tissue actively growing by cell-division, and known, therefore, as *apical meristem*. The distinction between cortex and stele is only recognisable a little farther from the apex, *i.e.*, in a slightly older region.

A careful study of development tells us that a defined ring of cells surrounding the stele is, in fact, the innermost layer of the cortex. It is made up of regular brick-shaped cells, smaller than those of the rest of the cortex, having their radial walls, those, that is, that lie in the radii of the root, marked with a black dot. This layer is known as the *endodermis*. Within the endodermis a microscopic examination further shows two rows of small thin-walled cells filled with protoplasm and known as the *pericycle*, the outermost portion of the stele. Within this again are eight, twelve, or more generally ten dark isolated patches of tissue in a ring, of which each alternate patch is darker than the greyish patch on either side of it. Between these patches and in the centre of the root-section are tissues only differing from the cortex in the smaller cross-section of their cells. This smaller transverse section of their component cells it is which gives the tissues of the stele their greyish appearance as contrasted with the whiter cortex. Longitudinal sections (which are necessary to elucidate the indications afforded by transverse ones) show that all the tissues of the stele are elongated in the direction of the elongation of the root itself. The darker patches are the cross-sections of the vascular bundles, the five (four or six) more conspicuous being known as *xylem bundles*, the others as *phloem*. The central mass of tissue is the *pith*. The xylem-bundles owe their conspicuousness to their consisting of *vessels*, or elongated fusions of vertical rows of cells, each of which is polygonal and thick-walled. In each bundle there are one, two, or three of these nearest to the pericycle, which are smaller, and have their walls thickened by a spirally-coiled inner band. These are the first to be formed from the primary meristem, and are, therefore, termed *protoxylem*. Nearer the centre of the root the vessels, which are formed later, are larger across and, instead of spiral threads, have their entire inner surfaces thickened with the exception of scattered spots or *pits*.

The patches of phloem are less conspicuous, as they are made up of vessels and cells with unthickened lateral walls. The vessels are known as *sieve-tubes*, because their transverse or end walls are pierced by numerous holes, and so resemble sieves. Between them are cells, generally still smaller across, without these sieve-plates.

The vessels of the xylem contain water and air only: the phloem retains its protoplasm. When, in fact, the root becomes active, the water in the soil, with soluble saline substances in an extremely dilute solution, passes into the cells of the cortex of the root, either from the root-hairs, if there are any—as there generally are during the first year—or from the hyphæ of the mycorrhiza. From the cortex the water passes through the unthickened walls of the endodermis and so through their unthickened portions into the xylem vessels and upwards to the leaves. The phloem, on the other hand, serves for the conveyance of the sap that has been “elaborated” in the leaves.

The young root, growing in length only in the region a little behind the apex, is pushed downwards into the soil. It turns away from light, or is, as it is termed, *negatively heliotropic*. Being very sensitive to contact, it bends out of its course to avoid all obstacles; and it is also strongly acted upon by gravitation, being, *i.e.*, positively geotropic. If, for instance, the seed is so placed in the soil that the radicle leaving its micropyle happens to go upward, it immediately turns downwards, dragging the seed round with it. The young root seems also to bend towards moisture and towards warmth.

In branching, the lateral roots originate in the pericycle opposite the protoxylem masses, so that they are at first arranged in five vertical rows from the basal part of the primary root—where they are older and longer—towards its apex. Where they originate, the outer row of pericycle cells gives rise to their root-cap and the endodermis becomes disorganised. The lateral root then forces its way out through the cortex, partly mechanically, partly by a process of chemical digestion, apparently the solvent action of a special ferment or “*amylolytic enzyme*,” so that when it issues at the surface of the parent root it is surrounded at its base by a torn sheath or

coleorrhiza. This deep-seated origin is termed *endogenous*. Being less acted upon by gravitation the secondary roots extend almost horizontally, whilst the subsequently produced tertiary or later branchings spread in all directions.

As the root gets older it increases in diameter and forms *secondary* tissues, the arrangement of which seems very different from that of the *primary* ones just described. In the pericycle a ring of cells undergoes division in a direction tangential to the surface of the root, and their outer halves become corky and impermeable, while the inner layer remains merismatic and repeats the process. The outer ring is known as *periderm*, the inner as *phellogen*, and the consequence of the impermeability of the former is that all the cortex external to it dies and is gradually thrown off. Meanwhile another generative layer or *cambium* forms further in. It originates by tangential divisions in cells just on the inner side of each of the phloem masses of the stele. This cell-division then extends from these places into the inner part of the pericycle on the outside of the primary xylem masses so as to form a continuous cambium-layer of thin-walled cells, retaining their protoplasm and their power of division. This cambium-layer subsequently continues to form new or secondary phloem on its outer surface on the same radius as the primary phloem mass, and consisting, like the primary phloem, of sieve-tubes and *companion-cells*. At the same time, however, it forms far more secondary xylem on its inner surface against the sides of, and between, the primary xylem masses. As the root gets older and thicker outer layers of periderm are split and worn off, but are replaced by the continued activity of the phellogen; and ultimately the pith surrounded by the primary xylem masses appears insignificant in the centre of thick annual layers of secondary wood. These rings are traversed radially by broad pith-rays, which each start from the outer (or protoxylem) end of a primary xylem-mass.

Though we shall find much that is different in the arrangement of the tissues of the stem, by a curious twisting in the region where one passes into the other the xylem and phloem of the root are continuous with those of the stem. They thus form continuous conducting systems.

THE STEM.

Between the cotyledons of the seedling may be seen the "plumule" or primary bud, which is the starting point of the shoot-system of the tree. Like other buds, it consists of an axis, or stem that has not as yet elongated, overlapped by rudimentary leaves; but, unlike the later-formed winter-buds, it is not enclosed in bud-scales. Its general structure is diagrammatically represented in Fig. 2, and that of the apex and growing-point of its stem portion in Fig. 3. The earliest growth of the stem consists in the elongation of the lowest



FIG. 1.—Rootlet of beech, with mycorrhiza.



FIG. 2.—Terminal bud, showing growing-point of stem, overlapped by rudimentary leaves with buds in their axils, the whole covered by dermatogen. In the centre is the stele to which descend the midribs of the leaves. (After Prantl.)

portion of this bud, that which is nearest above the cotyledons, and this is accompanied by the expansion into a horizontal position, one a little above the other, of the first two foliage-leaves. As long, however, as the main stem continues capable of elongation it remains terminated by a mass of embryonic tissue or "primary meristem," such as that represented in Fig. 3, and from this the permanent structures of the stem have their origin. An outer layer of more or less flattened cells still containing protoplasm is known as the "dermatogen," and will always be continuous, from the growing point backwards,

with the outer layer of cells covering the leaves and all that portion of any shoot which is less than one year old. The older portions of this outer layer, however, will have lost their protoplasm, save in certain special cells—the guard-cells of the “stomata,”—and their outer cell-walls will have become somewhat thickened and “cuticularised,” or lined with a cork-like modification of their original cellulose. These older portions are termed “epidermis,” the “dermatogen” being the generative portion of this layer. Its cells undergo division only in radial directions, so that it remains one cell thick.

Below the dermatogen of the growing-point are several layers of similar thin-walled polygonal cells also retaining their

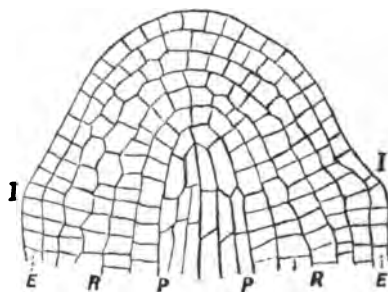


FIG. 3.—Growing-point of stem, showing apical meristem. *P*, plerome; *R*, periblem; *E*, dermatogen; *I*, rudiment of leaf. (After Leunis and Frank.)

protoplasm. This is known as the “periblem,” and is the generative portion of the cortical system which is continuous with that of the root, and, as we shall see later on, with a tissue known as “mesophyll” in the leaves. When traced back from the growing-point to somewhat older portions of the young stem an inner ring of cells can be found in this cortex similar to, and continuous with, the “endodermis” already described in the root. Towards the close of the first season’s growth it is in the outermost layer of the cortex that the formation of cork takes place; but until then the green chlorophyll-granules in the cells of this tissue, especially in its outer layers, are seen through the transparent epidermis, so that the young stem is green, and shares in this respect in the functions of the leaves.

In the centre of the rudimentary stem (Fig. 3) the cells are elongated. This is the "stele," and is continuous with that of the root, as are, in fact, the "xylem" and "phloem," which are, as we shall see, its most important products. When traced backward into a somewhat older portion of the young stem a ring of greyish patches are seen in a transverse section, such as Fig. 4, i. : but the number of these will be only half that of the "procambial strands" in the stele of the root. These procambial strands of the stem give rise to what are known as "conjoint" and "collateral" "fibro-vascular bundles," *i.e.*

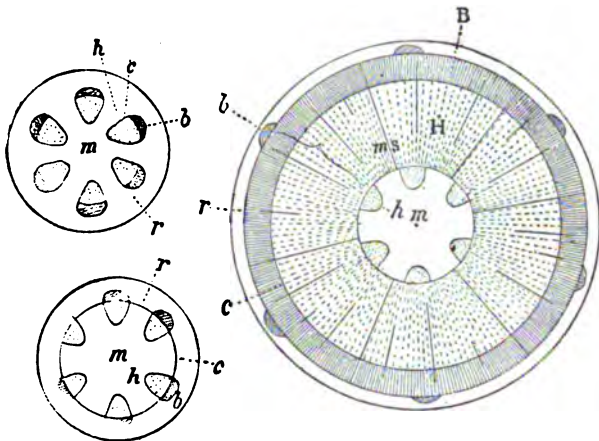


FIG. 4.—Three stages in the early development of an exogenous stem ; *m*, pith ; *r*, cortex ; *h*, primary xylem ; *H*, secondary xylem ; *b*, primary phloem ; *B*, secondary phloem ; *c*, cambium ; *ms*, pith-ray. (From "The New Popular Educator," by kind permission of Messrs. Cassell.)

each of them forms both xylem and phloem, and not, as in the root, only one or other of them, and the xylem is formed in the inner portion of each strand and the phloem in its outer portion. In the centre of the stele of the older part of the young stem is the pith or "medulla," the cells of which, though somewhat elongated, soon lose their contents and undergo but little change. The young shoots of the beech being slender, this pith is of inconsiderable thickness and can with difficulty be detected in the centre of an old but sound stem. Between the rudimentary bundles, which are wedge-shaped in transverse section, the "connective" or "ground" tissue of the stele

extends in the so-called "primary medullary rays" to the pericycle. In this last-mentioned region, opposite the outer portion of each bundle, a group of elongated cells with thickened walls and tapering extremities are formed. These are the "fibres of the pericycle" or so-called "bast-fibres."

The distinctive feature of the stems of perennial dicotyledonous plants is, however, that the whole of the procambial strand does not pass over into permanent tissue or xylem and phloem; but between the inner primary xylem and the outer primary phloem a layer of elongated cells, wider tangentially than they are radially and having wedge-shaped upper and lower ends, remain thin-walled, retain their protoplasm, and undergo tangential cell-division. At this division one half of the cell becomes permanent tissue, either xylem, phloem, or ray; but the other half remains like the cell which gave rise to it and is capable of dividing again. This part of the bundle is known as the "fascicular cambium," and, owing to its presence and the consequent power of the bundle to increase indefinitely in radial diameter, the bundle is termed "open." In the primary medullary ray between the bundles similar cell-division takes place, and thus a cambium ring, or rather cylinder, is formed round the stem (Fig. 4, ii.), the portions of it between the bundles being termed "interfascicular cambium." It is owing to the presence of this cambium layer, the cells of which filled with protoplasm are soft and moist in the growing season, that we can peel a stick readily in the spring, since we then tear through these cells, stripping off all the phloem and leaving all the xylem as the peeled stick. This cambium ring or cylinder by the division of its cells gives rise to a layer of xylem on its inner surface and to a less amount of phloem on its outer surface. This xylem and phloem is known as "secondary," to distinguish it from that formed directly from the procambial strands, which is styled "primary." The primary xylem now appears as mere points projecting into the pith (Fig. 4, iii.), its spiral vessels having formerly been known as the "medullary sheath." Similarly the primary phloem forms inconspicuous projections towards the cortex. It is to this growth of the wood by the addition of a new cylinder outside that formed in the previous year, or of a new "annual ring," as it is called,

that the stem of dicotyledonous plants owes the name "exogenous."

Whilst the secondary wood of conifers is comparatively uniform and simple in its structure, that of broadleaved trees is varied and far more complex. In the beech it is made up of four different kinds of "histological elements," as they are termed, viz., wood-fibres, wood-parenchyma, tracheids, and tracheæ, in addition to the pith-rays (Figs. 5 and 6). All of these result

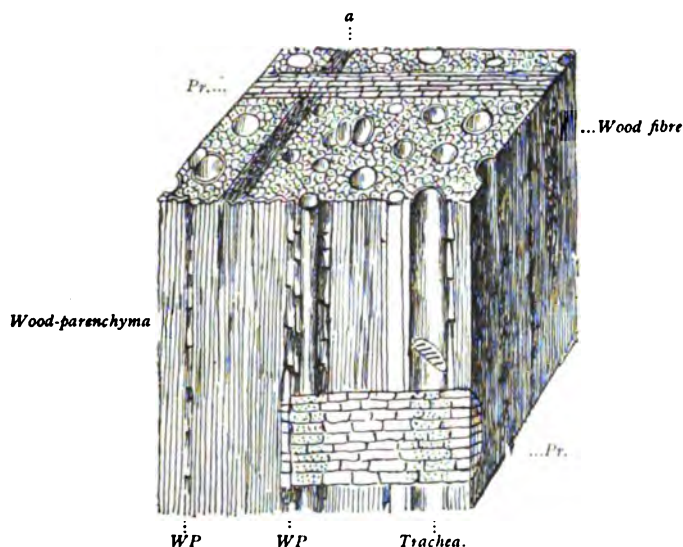


FIG. 5.—A piece of dicotyledonous wood (Beech) magnified about 100 times. A transverse section is shown above, with a pith-ray (Pr.) crossing the zone of autumn wood (a) which forms the outer boundary of an annual ring. In front is a radial longitudinal section.

equally from the modification of the cambium cells already described. The greater part of the wood is made up, as will be seen from these figures (of which Fig. 6 is taken by kind permission of Prof. Somerville, from Robert Hartig's "*Timbers, and how to know them*,") of wood-fibres. These are each formed from a single cambium cell: they may be over a millimetre, or nearly $\frac{1}{20}$ th of an inch long: their ends taper; and their walls are thickened and hardened with deposits of the woody substance known as lignin,

except at certain elongated slit-like places known as pits. These pits are opposite others in neighbouring elements, as is well shown at *c* in Fig. 6. Wood-parenchyma is made up of vertical rows each composed of several (five or six) but slightly elongated cells, wider than the fibres and with thin walls, the terminal cells of each row tapering. Each row results from the transverse division of a single cambium cell, the "septa" or divisional walls being pitted; and the cells

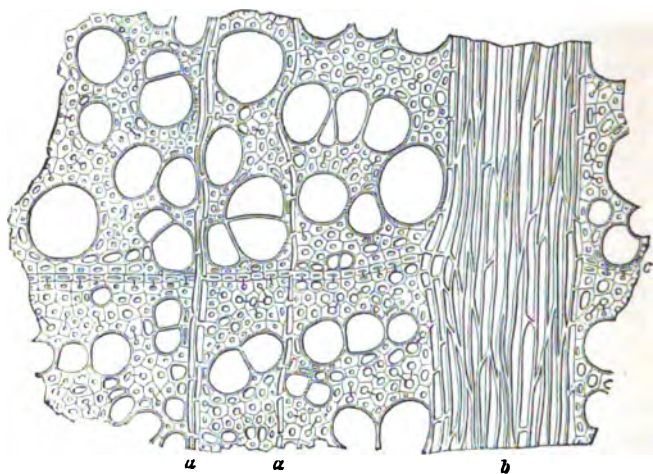


FIG. 6.—Transverse section of Beech (*Fagus sylvatica*). Magnified 100 times: *a*, narrow pith-ray; *b*, broad pith-ray; *c*, boundary of an annual ring. The large pores are transverse sections of vessels (trachea). The thick-walled elements with narrow lumina are wood-fibres; those with thinner walls and wider lumina, wood-parenchyma or tracheids.

retain their protoplasm or store up starch in granules. The tracheids are each of about the same dimensions as a row of wood parenchyma, with similarly thin walls, but with numerous slit-like pits and with no transverse septa. They serve as conducting tissue, containing only water and air. Each of them is formed from one cambium cell. The tracheæ, or true vessels, are of much greater diameter than any of the other elements—sometimes $\frac{1}{200}$ th of an inch—though this is scarcely wide enough to render them recognisable with the naked eye. They have



FIG. 7.—Tangential section of Beech wood, showing two broad pith-rays and numerous thin ones. (From "Wood," by G. S. Boulger, by kind permission of Mr. Edward Arnold.)

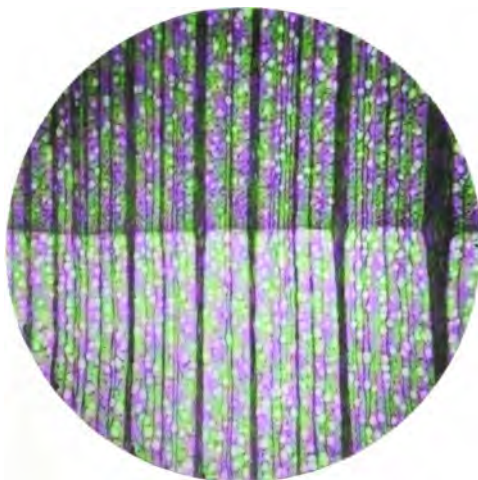
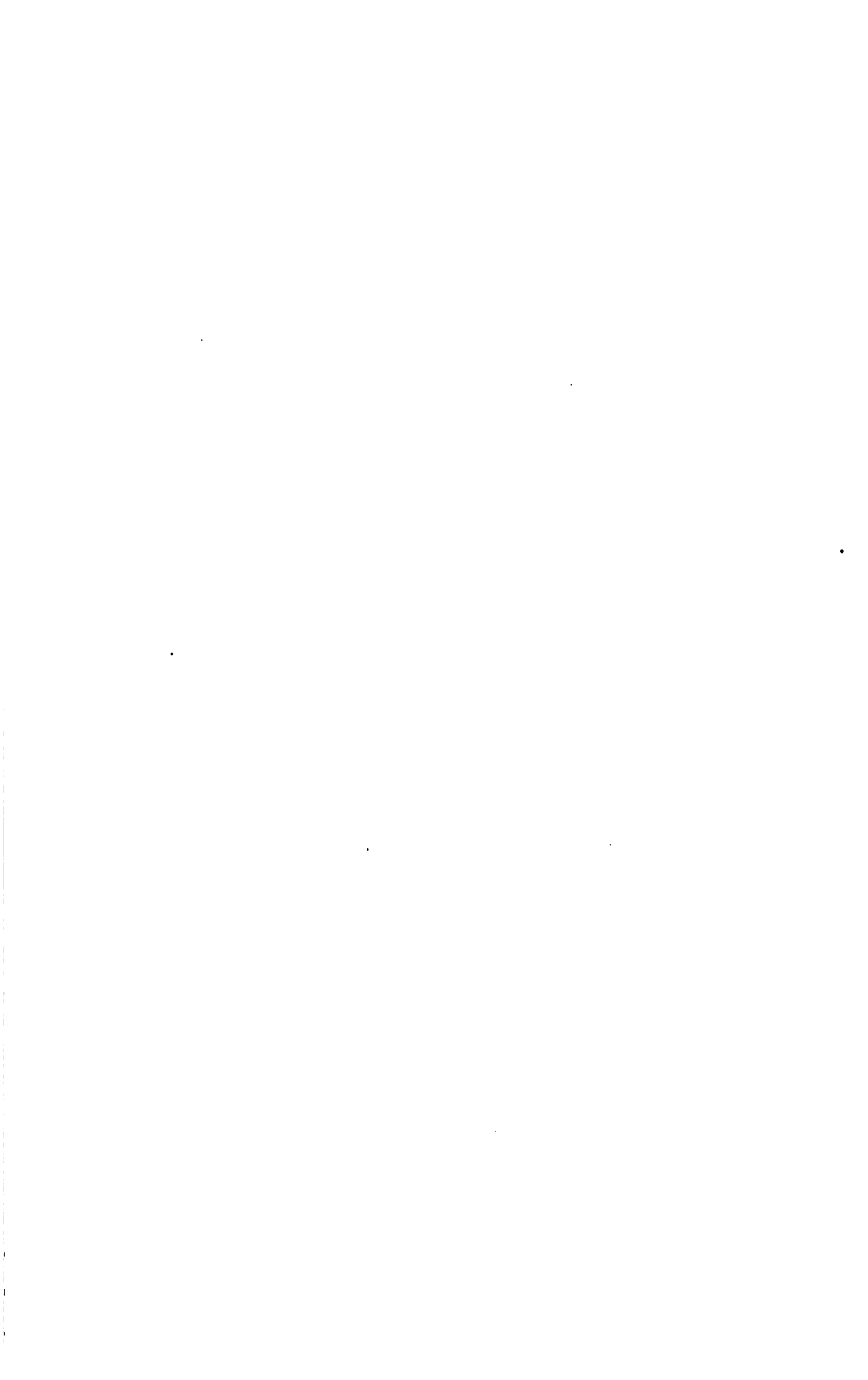


FIG. 8.—Portion of two annual rings of Beech wood in transverse section. (From "Wood," by G. S. Boulger, by kind permission of Mr. Edward Arnold.)



more or less absorbed or perforated obliquely transverse septa, being formed by the fusion of rows of cambium cells, not always exactly vertically superposed. Like the tracheids, they act as conducting tissue to convey the watery or "unelaborated" sap from the root to the leaves.

Unlike all these elements of the xylem, those forming the rays, which are somewhat misleadingly termed "pith-rays" or "medullary rays," are elongated in the direction of the radius, not in that of the axis of the stem. They are formed, like the xylem and phloem, from the cambium; and, when once a ray has originated at any spot in the cambium it is added to externally every year. It is also formed on both the xylem, or inner, and the phloem, or outer, side of the cambium; and thus every ray extends to the cortex on one side and into the xylem, if not to the pith, on the other. They are of no great vertical height, appearing as transverse stripes on a radial section of the wood (Fig. 5), or as more or less oval spots on a tangential section (Fig. 7). In the beech they are of two kinds, broad and narrow. The former are clearly visible with the naked eye, in a transverse section of the wood, and have a satin-like lustre. They form what is termed the "silver-grain" of the wood. As will be seen in Figs. 8 and 9, they widen out slightly at the close of each year's growth and the beginning of that of the next year. The thin pith-rays appear as mere radiating lines on these transverse sections, and are quite invisible to the naked eye. The rays are made up of tracheids and thick-walled parenchyma, both with pitted walls, the latter containing starch-grains. The broad visible rays only occupy about one-tenth of the surface of a section of beech wood, whereas those of the otherwise similar wood of the plane occupy a half. The vessels (tracheæ), the transverse sections of which are commonly called "pores," are in beech wood equally distributed through the wood formed in spring and summer, *i.e.*, throughout the greater part of the annual ring, without definite order or variation in size, whence beech wood is classified as "diffuse-porous"; but they are much scarcer in the outermost or autumn-formed portion of each ring, so that that part of the wood appears darker. The wood parenchyma is arranged in peripheral lines between the other elements of the wood.

It may also be noticed that the annual rings bend a little inwards between each pair of broad rays. In a full-grown beech stem the pith appears as a small triangular area in transverse section.

Beechwood varies in colour, according to the soil upon which it is grown, from red to yellow or white, the red, grown on richer soil, being the better. The inner, or older wood of a stem, containing least water, is, when fresh cut, lighter than the outer; but becomes redder on drying; and beechwood in general is known in Germany as red beech in contradistinction to the hornbeam, which is called white beech. The wood has a specific gravity of 700 to 720, averaging 705 (water being taken as 1000), *i.e.*, a cubic foot weighs 43 to 53 pounds. Professor Wolff (*loc. cit.*) gives the following analyses of the wood of the trunk, branches and brushwood respectively, when air-dried:—

	Water.	Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphorus pentoxide.	Sulphur trioxide.	Silica.
Trunk .	15	55	09	02	06	31	03	01	03
Branches	15	89	14	02	15	41	10	01	06
Brush .	15	12	17	03	13	59	15	01	12

He also gives the following ash-analyses:—

	Percentage of ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphorus pentoxide.	Sulphur trioxide.	Silica.	Chlorine.
Trunk .	65	16.1	3.4	10.8	56.4	5.3	3	4.8	.6
Branches	105	15.2	2.1	16.8	45.8	11.6	1.0	4.7	.1
Brush .	145	14.1	2.2	10.8	48.0	12.3	.7	6.7	.1

At an early stage in the history of the slender twigs of the beech, cell-division parallel to their surface takes place in the outermost layer of their cortical tissue. It originates at numerous points beneath stomata (*vide infra*) in the epidermis and spreads from these points over the whole surface. Each



FIG. 9.—Portion of the same $\times 30$ diams. (From "Familiar Trees," by G. S. Boulger, by kind permission of Messrs. Cassell & Co.).

cell as it divides forms two differing halves; the walls of the outer half become cuticularised and lose their contents, while the inner half retains its protoplasm and, after growing to the size of the original, divides again. The outer or "periderm" cells at the points where this tissue first forms are rounded; they burst through the epidermis, and form what are known as "lenticels" or "cork-warts." These are more distinctly visible on the branches than they are on the main stem of the beech. Elsewhere the periderm cells are brick-shaped and remain in contact, thus replacing the ruptured epidermis by a smooth, polished, olive or greyish-brown surface of cork, the cells of which are capable of a considerable amount of stretching as the twig increases in girth. It is, however, somewhat characteristic of the beech that the active inner halves of these cortical cells, which are known as the "phellogen" or "cork-cambium," are capable of division not only tangentially, as is commonly the case, but also radially. This permits indefinite expansion of the stem, as new rings of wood originate without any loss of the original smoothness of the rind; and this rind, though sometimes rough, never acquires the thickness common in other trees. Professor Wolff gives the following ash-analysis of beech bark:—

Potash 14.7; soda 0.4; magnesia 0.2; lime 57.9; phosphorus pentoxide 0.4; sulphur trioxide 1.3; silica 18.0.

Below the periderm of the mature stem is a "phelloderm" or buried layer of cells containing chlorophyll; and below this again, in the inner bark (the elements of which are not long like the bast-fibres of the linden) there are numerous dense "stone cells" or sclerenchyma.

It is quite a common thing to find swellings on the trunk of a beech, known as "knurs" or "knauers," or technically as "sphæroblasts." They vary in size from a pea to over two inches in diameter, and may easily be detached by a smart blow with a stick or be dug out with a knife. They will then be found to consist of a solid nodule of wood just beneath the bark.* The sphæroblast originates in a dormant bud, the base of which became at an early stage of its development separated from the wood beneath. "The cambium then closed in over

* Rev. C. A. Johns, "Forest Trees of Great Britain," 8th ed., p. 150.

the base and laid on thickening rings all round the axis of the bud except at the extreme apex. When the separation occurred the cambium of the wood beneath covered over the previous point of juncture, and thus the woody bud was pushed out with the bark," and is covered only with a thin layer of it.*

Other similar, but undetached, dormant buds give rise to the "epicormic shoots" with which the bare stems of beeches will clothe themselves when, after having been hitherto shaded by others, they are exposed to light and air by the felling of surrounding trees.†

Not only is the axis of the seedling beech very susceptible to frost in its earliest stages, but for some years it is a very slow-growing species. At five years old it is scarcely more than 2 to 2½ feet high, whilst its tap-root will then have grown to about that depth.‡ In this early stage the tree is exceptionally tolerant of shade; but it is stated§ that after growing vigorously to about this height when under deep shade it will remain for a long time almost stationary unless light is admitted. Büsgen states that it reaches its maximum growth in height between twenty-five and forty-five years of age, when its leading shoot is growing from 12 to 27 inches a year.|| Under favourable circumstances the beech may reach a height of 10 feet in five years, and 25 feet in ten years; and ultimately, when drawn up by other trees it may be 100 to 150 feet high; but its usual full size is from 50 to 80 feet, a size which it may have attained at from sixty to eighty years of age. It seldom probably increases in height after 100 years of age, and its life in a crowded wood does not often extend beyond 150 to 200 years.¶ The beech is not well adapted for coppicing, as it ceases to send up coppice-shoots when more than thirty or forty years old, owing, according to Mouillefert (*loc. cit.*) to the impenetrability of its bark. No other British broadleaved

* Prof. H. Marshall Ward, "Disease in Plants" (1901), pp. 225-6.

† Prof. H. Marshall Ward, "Trees" (1904), vol. i., p. 39.

‡ Prof. P. Mouillefert, "Traité de Sylviculture," vol. i. (1903), p. 133.

§ Prof. G. Bagneris, "Manuel de Sylviculture," ed. ii., p. 65.

|| Büsgen, "Bau und Leben unserer Waldbäumen" (1897).

¶ Loudon, "Arboretum et fruticetum Britannicum," p. 1954; and Mouillefert (*loc. cit.*).

species grows so long or so straight a stem, especially when in a sandy soil rich in humus. Towards the northern limit of the distribution of the species it tends to develop branches at the expense of the bole.* The branches generally take an upward direction, forming acute angles with the stem; but in old trees the lower branches will often be horizontal when the tree is

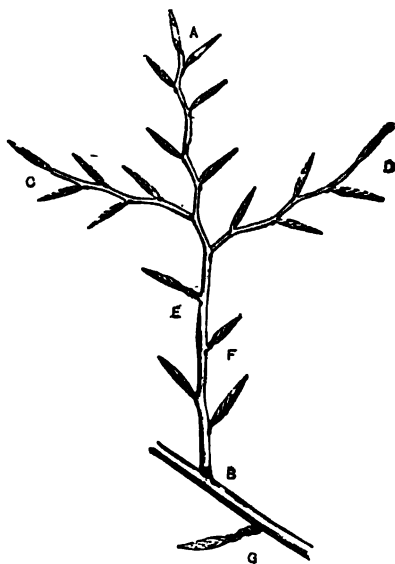


FIG. 10.—A twig. A, the apex of the preceding year's growth into a long shoot; B, bud-scale scars at its base. It bears buds such as F in the axils of the now fallen leaves, two of which had already grown out into long shoots C and D before the winter rest, and one E into a dwarf-shoot. G a dwarf-shoot, developed during the same season as the long shoot A—B. (From "Trees," by Prof. Marshall Ward, by kind permission of the Cambridge University Press.)

isolated, bending downwards in the middle and turning upwards at their extremities. The branches of every order are numerous and the twigs branch in a very zigzag fashion, though owing to the acute angles which they make they do not appear to do so as much as those of the oak.

* Nisbet, "British Forest Trees," p. 157. M. Gateau de Kerville, in his "Les vieux arbres de la Normandie," figures a beech at Montigny, from 600 to 900 years old, and measuring $58\frac{1}{2}$ feet high, and over $26\frac{1}{2}$ feet in girth at 3 feet from the ground.

"If we examine one of the stronger sprays of foliage of a beech in autumn, just after the leaves have fallen, and at the end of the seasonal growth, it will be seen that the development of the shoots from the buds which opened last spring varies considerably."* Whilst some of them have elongated and borne leaves separated by considerable internodes and with axillary buds; others have grown much less and have borne fewer leaves with hardly any internodes and no axillary buds. The former are termed "long," the latter "dwarf" shoots.

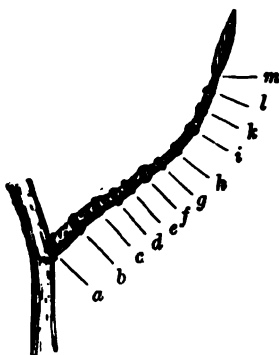


FIG. 11.—Dwarf shoot. The letters *a—m* point to the bud-scale scars of successive years, so that the shoot is 11 years old. Below *a* is visible the scar of a leaf from the axil of which the bud originated, above *m* is the terminal bud of this year. Between each set of bud-scale scars are the crowded scars of fallen leaves. (From "Trees," by Prof. Marshall Ward, by kind permission of the Cambridge University Press.)

While the former will bear at its base the ring-like scars of the deciduous bud-scales of the bud from which it originates, the latter may in a short space have many groups of such scars, marking the scales of its one terminal bud in a long series of years (Figs. 10—14). It may be noticed that an axillary bud makes a more acute angle with the shoot that bears it than does a dwarf shoot.

The branches of beech trees are very liable to cross and grow into each other by a process of natural grafting or inarching, the bark being rubbed away as they sway in the

* Prof. H. Marshall Ward, "Trees," vol. i. (1904), p. 77.

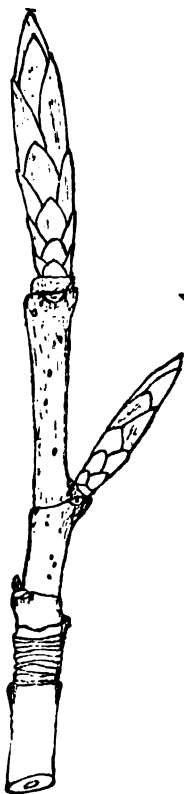


FIG. 12.

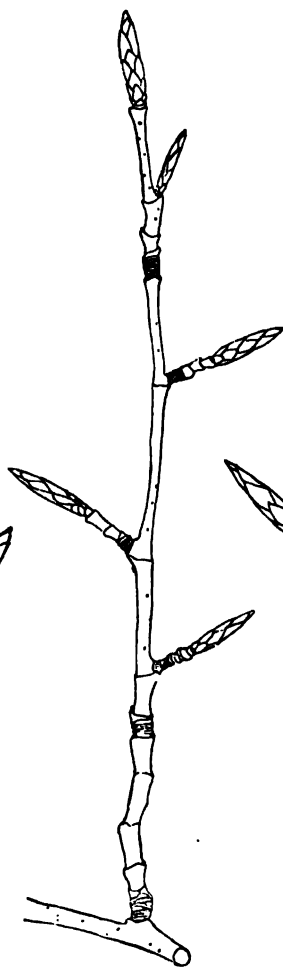


FIG. 13.



FIG. 14.

From "Trees," by the late Prof. H. Marshall Ward, by kind permission of the Cambridge University Press.

wind, until their two cambium-layers come in contact. It has been suggested that this gave the first idea of artificial grafting.*

* Loudon, "Arboretum et Fruticetum Britannicum," pp. 1954—5 and 1907; and Prof. H. Marshall Ward, "Disease in Plants," p. 269.

The chief animal enemy of the stem of the beech, at least among the higher animals, is the squirrel, which, when pressed for food, will tear off strips of bark several inches in length from the lower part of the stem in order to get at the moist inner bark and young wood. It has, for this reason, been found necessary to smear the lower five or six feet of young stems with tar and grease. Deer, cattle and rabbits do some similar damage; but all these put together are not to be compared in importance to the minute Felted beech coccus (*Coccus fagi*). As to the characters and treatment of this deadly pest we can add nothing of value to Leaflet No. 140 issued by the Board of Agriculture and Fisheries, which we, therefore, annex, by permission, as an appendix to this essay. The larvæ of various beetles damage the cambium and sapwood of young growth. Of these the most serious is the Buprestid, *Agrilus fagi* Ratz., a beetle about 0·24 inch long and of a lustrous blue or green colour, which swarms in June and July, when the female lays her eggs in the bark of saplings.

The larvæ eat sinuous galleries into the sapwood and kill young shoots; but it is stated that only unhealthy trees are attacked. *Scolytus intricatus* Fab. develops beneath the bark of dying trees, and various species of the bark-beetles, viz., *Bostrychus typographus*, *monographus*, *bicolor*, *curvidens*, *fagi*, *autographus* and *dispar* produce the "worm-holes" which are only too common in beech timber.*

Like other trees with a smooth bark, especially where, as in this case, the bark is also thin, the beech is particularly liable to sun-cracks and to necrosis, which is often due to frost. The former affects the base of the bole on the west or south-west side, where heat is most reflected from the soil, and occurs soon after the spring sap has begun to rise. Exposure of previously sheltered stems by thinning is apt to bring this about, and the cracks and their healing are very similar to those due to frost. Necrosis is the death of patches of cortex, which turn brown and black and dry up. The living cambium and phellogen round such patches grows out under the dead

* Nisbet, "British Forest Trees," p. 161. H. Fürst, "The Protection of Woodlands" (Eng. trans., 1893), p. 198. Mouillefert, "Traité de Sylviculture," vol. i., pp. 137—8.

tissue; but if this dead bark splits off, fungal spores may obtain access to these delicate cambium margins and set up canker.*

Of the fungi attacking the stem of the beech the most serious is probably this canker (*Nectria ditissima* Tul.); and though it may attack trees of any age, it can only apparently infect the tree at a wound-surface, such as those produced by sun, frost, hail, or mechanical injury. The spawn or "mycelium" of the fungus spreads in the wood, turning it brown and killing it: a swelling due to hypertrophy takes place round the margin of an oval diseased area; and small white pustules appear. These were named *Fusidium candidum* by Willkomm; but were subsequently shown by Robert Hartig to be merely a conidial, or asexual, stage of *Nectria*. These white pustules are followed by the dark-red globular fructifications to which the name *Nectria* was first given. This canker mycelium may spread from branch to branch until a whole tree may die; nor is there any remedy save the destruction of all affected trees or branches to check the spread of the infection.†

The black slime sometimes seen to issue from old wounds in beech stems is said by Professor Marshall Ward to contain yeasts, bacteria and fungi; but he considers these to be merely saprophytic, the slime itself being primarily due to exudation of sap under root-pressure. Ludwig states the exudation to be caused by the Algæ, *Scytonema Hoffmanni* and *Hormidium parietinum*, while Mouillefert suggests that it is bacterial in origin.‡

Lastly, the dead-white colour sometimes seen on the bark of beeches from ten years old upward is the result of various lichens, especially *Verrucaria epidermidis*, *Graphis scripta* and *Opoglyphia varia*, which live in and on the periderm.§

* Nisbet, "British Forest Trees," p. 162; and H. Marshall Ward, "Disease in Plants" (1901), pp. 240—242.

† Nisbet, "Studies in Forestry" (1894), pp. 298—299; and "British Forest Trees," p. 162. R. Hartig, "Lehrbuch der Baumkrankheiten," ed. ii. (1889). Canker occurs mostly on the west side of the stem.

‡ Marshall Ward, "Disease in Plants," pp. 233—234; Mouillefert (*op. cit.*), p. 138.

§ Mouillefert (*op. cit.*), p. 139.

THE BUD.

No character is so distinctive of the beech as its buds.

There are other trees with smooth grey stems, others with glossy or pinnately-veined leaves ; but the long, pointed brown



FIG. 15.—Winter-bud. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)



FIG. 15A.—Bud just on the point of opening, showing leaves protruding from between the pairs of stipular bud-scales. (From "Trees," by Prof. Marshall Ward, by kind permission of the Cambridge University Press.)

buds, springing at a considerable, though acute, angle from the twigs and with their polished surface, afford an easy mode of certain recognition.

These winter-buds are formed mainly in autumn, when "the tips of the shoots cease to form leaves, but continue to develop stipules, which act as bud-scales." These terminal buds,

however, are often subsequently aborted, the growth being continued by the lateral ones which arise singly in the axils of the foliage leaves, *i.e.*, in the angles between them and the stem that bears them. These lateral buds spring from the long bare twigs from November to May, at an angle of 60 degrees to 70 degrees, in two rows alternating on either side of the twig, or, as it is termed, "distichous." They are spindle-shaped and pointed, from half an inch to three-quarters of an inch long and only from a quarter to one-sixth as broad, being thickest at about one-third of their length from their base. On their exterior they expose a number of scales (more than twenty), generally of a warm tawny brown colour and with a polished surface. These scales overlap like the tiles of



FIG. 16.—First or lowest pair of stipules. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)



FIG. 17.—Sixth pair of stipules, overlapping at the corners. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

a house, or "imbricately," in four vertical rows, and appear to be arranged in opposite pairs, though more careful study shows them to be truly in a spiral. Though it is not by any means the rule in the buds of other plants, these bud-scales are all stipules, *i.e.*, they represent the generally small and deciduous paired appendages which occur at the base of many leaves. Linnæus gave to these appendages the name of stipules, from the Latin *stipula*, a little straw, a description more applicable to them in the case of the beech than in many other plants. The terminal bud is straight; but the lateral ones curve towards the twig from which they spring. Before unfolding they turn upwards, but as they open in May they bend downward. The buds vary in size and in the number of scales and leaves they contain; but Lord Avebury gives the following detailed account of the component parts of an average bud.* I have merely

* Marshall Ward, "Trees," vol. i., p. 175. Avebury, "On Buds and Stipules" (1899), pp. 130—134.

altered the numbering of the Figures (our 15 to 26 inclusive) from the latter work kindly lent by Messrs. Macmillan.

Describing the bud-scales, Lord Avebury writes:—"The first pair (Fig. 16) are small, triangular, and pointed. The five following are also triangular, each rather larger than the preceding and more convolute, till they almost enclose the upper part of the bud. The lower ones are brown and coriaceous; the upper membranous, and furnished with numerous straight, longitudinal, parallel, slender veins running from the base to the apex. The covered parts are white, the exposed brown. The upper ones are fringed with long, recurved, silvery or



FIG. 18.—Eleventh pair of stipules, showing how one is rolled within the other: *L*, position where the leaf should be, though it is yet absent. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)



FIG. 19.—Diagrammatic transverse section of the stipules, showing the extent to which they overlap. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

satiny hairs. They are sometimes a brilliant pink or rose colour after expansion, but less often than those of the hornbeam. The fifth and sixth pairs (Fig. 17) are ciliate with short hairs, and rolled round a considerable part of the bud. The seventh pair are half as long as the bud, but otherwise like the sixth; the eighth pair, two-thirds as long as the bud; the ninth, nearly as long as the bud, with silky hairs directed downwards, and the outer one of the two distinctly overlaps the inner. The tenth pair are as long as the bud, and each is convolute, so as to cover nine-tenths of the bud, or even more. The eleventh pair (Fig. 18) are similar, and almost meet at their edges. These eleven pairs of stipules show no traces of a leaf. Fig. 20 represents a bud after the removal of

the first eleven pairs of stipules. About the twelfth pair there is a material change; they (Fig. 21) are smaller, and between them is a leaf-blade; this is about one-third as long as its stipules, concave on the inner face, and plicate along the course of the ascending lateral nerves. The thirteenth pair



FIG. 20.—The bud after eleven pairs of stipules have been removed: *l*, the first leaf; *st st*, the twelfth pair of stipules; *e e*, the edges of the outer one of the twelfth pair. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

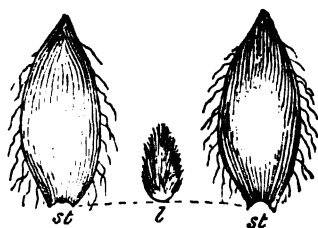


FIG. 21.—*st st*, the twelfth pair of stipules flattened out; *l*, the first leaf belonging to the same. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

of stipules (Fig. 22) are rather narrower, especially at the base. The leaf is about half as long as the stipules. The fourteenth pair (Fig. 23) are much smaller, thinner, narrower, and unequal, the inner one being the smaller. The leaf is three-fourths as long as its stipules. The leaf (Fig. 24) belonging to the fifteenth pair is longer and more bulky than the stipule.

The next leaf (Fig. 25) is large, deeply concave, or rolled into a cylinder, occupying the centre of the bud, and densely covered with silky hairs on both surfaces, but particularly on the back, as are all the others. . . . If the branch is examined,

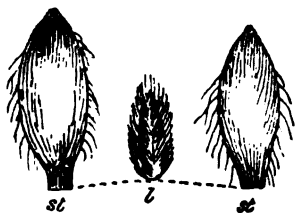


FIG. 22.—*st st*, the thirteenth pair of stipules; *l*, the second leaf. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

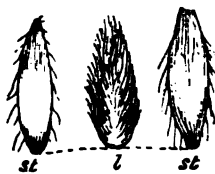


FIG. 23.—*st st*, the fourteenth pair of stipules; *l*, the third leaf. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

the scars where the stipules were inserted may be seen, forming rings (Fig. 26) round the base of each annual shoot. The shoot elongates considerably between the leaves, but not between the stipules, so that the stipular rings remain close.



FIG. 24.—*st*, the only stipule of the fifteenth pair discernible in this bud; *l*, the fourth leaf. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)



FIG. 25.—No stipule discernible in the bud examined; *l*, the fifth and last leaf discernible, occupying the centre of the bud. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

together; these are very persistent, and can be traced for twenty-five years or more. The long, narrow, brown stipules of the bud are thrown off when the leaves expand, and may be found in large numbers under the trees."

Curious slight changes in the colour of the buds just before

they unfold may be noticed. They were graphically described long ago by Mary Roberts, a native of the quiet Quaker village of Painswick, on the beech-clad Cotteswold Hills. "Virgil," she writes, has "elegantly given to the vernal season the epithet of *blushing*, because the shoots and buds of trees assume a ruddy appearance previous to throwing out their leaves. This beautiful effect is very obvious in the deep beech woods of Gloucestershire. . . . A casual observer might ascribe it to a drier air, a clearer atmosphere, or to those transient gleams of sunshine which seem to light up the face of Nature with a smile. But the effect arises from that secret renovation



FIG. 26.—Junction of the wood of two seasons' growth ; *sc. st.*, scars of the outer eleven pairs of stipules that covered the winter bud and were unaccompanied by leaves. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

which the aged fathers of the forest and their sapling sons are now experiencing. The swelling buds are first brown, then bronze, then of a reddish hue, and thus they continue till a light green bough is seen to wave, as if in triumph, from some warm, sheltered nook. This is the signal for a general foliation; and he who retires in the evening, casting a look at his beloved woods, rather wishing than expecting that another week will cover them with leaves, often rejoices the next morning to observe that the whole forest has burst into greenness and luxuriance."*

It is perhaps worthy of notice that the same tree, and even the same branch, may be observed to be the first in the grove

* "Annals of my Village."

to unfold its buds year after year. As the buds open they undergo a marked change in direction. Having previously pointed upward, they now bend more and more downward until the leaves are fully expanded, when, in the course of a week or two, they regain a horizontal position. This is probably connected with the susceptibility of the young and delicate foliage to the cold radiated from the ground beneath them at a season when morning frosts are frequent. Many, if not most, trees have their leaves more or less vertical as they emerge from the bud; and it has been found as the result of experiment with newly expanded beech leaves that if fixed artificially in a horizontal position they are more often frost-bitten than when in the natural position, in which less surface is directly exposed.

THE LEAF.

Of all the many beauties of an English spring, few are more beautiful than the young foliage of the Beech, especially when, standing beneath the tree, we gaze up through the dappled translucence of its verdant shade to the blue of a May sky. Isolated trees, it is true, will feather their boughs down to the ground; but this is done by the downward sweep of the laden but bare principal branches, while the leaf-bearing ultimate "spray" here, as in less drooping growths, is in the main horizontal. To be more accurate, we should say that the leaves are "diaheliotropic," arranging themselves at right angles to the direction of incident light. This they can readily do. They are "distichous"—*e.g.*, their attachments or "insertions" on the twig are in two rows, so that, were the shoot vertical, leaf 3 would be vertically over leaf 1, leaf 4 vertically over leaf 2. They are thus given off right and left of the branch whence they spring, in one plane. They are on an average one and a quarter inches apart at the base, and spring from the twig at angles generally less than 40 degrees. Each leaf is elliptic, ovate, or oblong-ovate, measuring 3 to 15 centimetres, or more usually 4 to 9 centimetres, long, and 2.5 to 10 centimetres, or more usually 3 to 6 centimetres, broad. Their petioles or stalks are short, ranging from 5 to 15 millimetres, though this is sufficient to allow of any slight twist which is necessary to bring

the blade into the diaheliotropic position. The result of these dimensions is that "the outline of the basal half of the leaf fits neatly to the branch, that of the upper half follows the edge of the leaf beyond, and the form of the inner edge being thus determined, decides the outer one also.* The leaves on the spray thus form a closely-adjusted "leaf-mosaic," admirably



FIG. 27.—Mature Beech Leaf. (From "Trees," by the late Prof. Marshall Ward, by kind permission of the Cambridge University Press.)

adapting themselves to secure the maximum of light and air. As a consequence, spray above spray in any beech tree of considerable size afford a very perfect shelter from rain and, when the foliage has lost its pristine translucence, a very perfect shade.

The leaves have generally a short and broad point, such as may be formed by two margins converging at an angle of

* Avebury, "Flowers, Fruits, and Leaves," and "Seedlings" (Popular edition, 1896), pp. 3—4.

approximately 90 degrees, which may be sufficient, as has been suggested, to act as a discharging point for atmospheric electricity, or to drain the upper half at least of the upper surface. The margin is generally slightly waved or "sinuate," from a somewhat luxuriant growth of the cellular tissue between the ends of the secondary veins, and along the upper two-thirds there are microscopic outward pointing serrations. The margin tapers towards the base in directions roughly parallel to the lowest secondary veins, but is generally a little rounded at its actual junction with the stalk.

The veins—or, as they are called by varying but unsatisfactory analogies, ribs or nerves—are arranged in a strictly "pinnate" manner. There is a midrib, projecting prominently along the under surface and forming a channel on the upper, maintaining

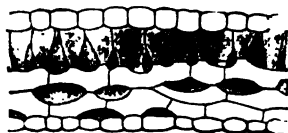


FIG. 28.—Transverse section of a leaf grown in shade. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

its considerable thickness to about the middle of the leaf, and then tapering to the apex. From this midrib about seven strong secondary veins diverge alternately on either side at angles of 35 degrees to 45 degrees, running straight nearly or quite to the margin. They diverge slightly from one another, and their attenuated ends may branch slightly near the margin and join one another in fine loops. These secondary veins are also prominent on the under surface. The two nearest the base are much shorter than the others and diverge more outwards. Between the secondary veins is a complex well-developed network of finer tertiary veins which do not project.

While in the bud the leaves are folded, or "plaited," as it is termed, parallel to the secondary veins; but, unlike the leaves of the hornbeam, when fully unfolded they become quite flat above. The leaf is always thin and somewhat hard in texture, almost suggesting a thin sheet of mica; and when

first opening, the under surface, the margin and the veins are silky with fine, soft white hairs. These, which are perhaps a protection against the rotting influence of adhering moisture, disappear as the leaf gets more mature. At all stages the leaf, especially on its upper surface, has considerable polish. There is a considerable admixture of yellow or brown in the colour of the young leaves, giving them an olive or russet tint. They bear at the base of their short downy leaf-stalks two thin membranous, narrow and pointed stipules, which fall off as the leaves expand.*

Strasburger has given † a somewhat detailed account of the

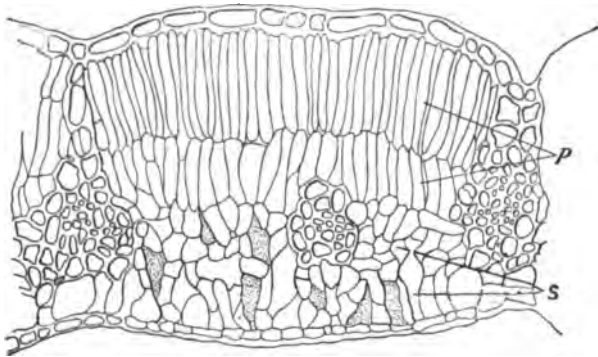


FIG. 29.—Transverse section of leaf grown in sunshine. Much enlarged: *p*, palisade layer; *s*, spongy parenchyma. (From Lord Avebury's "British Flowering Plants," by kind permission of Messrs. Macmillan & Co.)

internal structure of the beech leaf. While both surfaces are covered with an "epidermis" of one layer of cells, polygonal in plan but appearing brick-like or "muriform" in section (Figs. 28 and 29), with their outer walls thickened and cuticularised, only the epidermis of the lower surface has "stomata" or transpiration-pores. Each stoma consists of two more or less kidney-shaped "guard-cells," smaller than ordinary epidermal cells, but retaining both protoplasm and chlorophyll, and being thus actively engaged in photolysis (*vide infra*) and constantly changing their form under the influence of light

* Marshall Ward, "Trees," vol. ii., pp. 284—286.

† "Handbook of Practical Botany" (Eng. trans.), 1887, pp. 164—169.

and opening or closing the aperture between them. This aperture communicates with a large air chamber within and through it all the interchange of gases and water-vapour with the atmosphere, whether inhalent or exhalent, takes place.* These air-chambers below the stomata communicate with others between the loose network of variously-shaped, thin-walled pale green cells known as the "spongy parenchyma" (*s.* Figs. 28, 29). "It is, therefore," says Strasburger, "a ventilating tissue (perhaps preferably an aërating tissue). It is also a transpiration tissue, since from the surface of its cells especially copious evaporation takes place into the intercellular spaces." As is indicated by the presence of chlorophyll-granules or chloroplastids, these cells also carry on to some extent the function of photosynthesis, which is, however, more particularly the function of the closely-packed, dark green, prismatic "palisade cells" (*p.* Figs. 28, 29), which lie below and at right angles to the upper epidermis. As will be seen from Fig. 28, these palisade cells are often separated from one another, and especially at their lower ends, while they invariably touch some cell of the spongy parenchyma. Hence, while they are called *par excellence* the "assimilating tissue," they apparently hand on the products of their action to the more deeply-seated spongy parenchyma. "Single cells, devoid of chlorophyll, but with a cluster-crystal or 'sphaeraphides,' are interposed in the spongy parenchyma."

The midrib and secondary veins, as we have seen, project from the under surface of the leaf. "The projecting part is about as thick again as the other parts of the leaf. The fibro-vascular bundle has its course in the projecting rib. This latter is covered with elongated epidermal cells, to which follow elongated collenchymatous cells"—cells, that is, with thick but soft and flexible walls. "To these adjoin cells each of which contains a simple crystal; and then follow the sclerenchyma fibres which ensheath the whole bundle," or "meristele," as it is now termed. "On the upper side the palisade layer is interrupted at a narrow part over the fibro-vascular bundle, and is replaced by collenchyma, to which a

* F. F. Blackman, "Phil. Trans."

narrow strip of elongated epidermal cells follows. A layer of chlorophyll-containing cells surrounds the sclerenchyma sheath, and to these the cells of the spongy parenchyma join on. The ribs represent the mechanical system of the leaves, which must be constructed firm against flexure. . . . By means of them the leaf-blade is tightly expanded, and attains thereby the necessary firmness to protect it from tearing.*

"Smaller fibro-vascular bundles are protected on the upper and under side only by some sclerenchyma fibres. The ultimate branches of the veins are devoid of sclerenchymatous cover, and directly surrounded by the sheath of parenchyma. These smaller bundles have both on the (upper) xylem and (lower) phloem sides crystallogenuous cells. Above and under them the epidermal cells are somewhat elongated, and form shallow, depressed streaks."

The veins of the leaves are made up of an upper xylem, consisting of spirally-thickened tracheids for the most part, and a lower phloem containing sieve-tubes, and the narrower thin-walled cells containing protoplasmic contents, known as "companion cells." The number of elements diminishes as we trace the veins into their finer ramifications. The xylem and phloem of these veins is continuous with that of the stem, and while the former conveys into the leaf by way of the sheath of parenchyma, the unelaborated watery sap from the root, the latter serves to conduct out of the leaf to any growing tissue of the tree, such as its cambium and its buds, the "elaborated sap" enriched with the organic compounds built up at least mainly in the palisade cells.

The beech exhibits a remarkable example of the difference in thickness and in structure of leaves grown in sunshine and leaves grown in shade. These differences have been described by Stahl† and by Lamartière. When grown in the shade there is only one layer of palisade cells, as in Fig. 28, and the leaf is only from one-third to two-thirds the thickness it is when grown in the sun. When grown in the sun, as seen in Fig. 29,

* Haberlandt, "Handbuch der Botanik," vol. ii., p. 614; Sachs, "Lectures on Plant Physiology."

† Stahl, "Ueber den Einfluss des sonnigen oder schattigen Standortes auf die Ausbildung der Laubblätter," *Jenaischer Zeitschrift für Naturwissenschaft*, vol. xvi. (1883).

there are two or more layers of palisade cells, making up the bulk of the much thicker and darker green leaf. M. de Lamartière gives the following measurements in 200ths of a millimetre:—

Upper epidermis	3 in sunlight, 2 in shade.			
First layer of palisade	10	"	5	"
Second " "	6	"	0	"
Spongy parenchyma	9	"	6	"
Lower epidermis	2	"	2	"
<hr/>				
Total	30		15	*

To these structural details we may add a few physiological remarks on the leaves during their active life. We have already seen that the branching and leaf-arrangement ensure a maximum exposure to air and light, and that the veins, especially the sclerenchyma sheath round the midrib and the few sclerenchyma fibres above and below the smaller veins, perform the mechanical function of keeping the leaf expanded. The tracheids of the central xylem of the midrib are directly in continuity with those of that of the stem-structures on the one hand and with those in the upper portion of the finer veins on the other; and it is through them that the transpiration current conveys water from the root and thus maintains the state of stretch or "turgor" essential to all vital activity in the leaf-cells and the supply of nitrogen and saline matters requisite in assimilation.† The continuity of stem and leaf is further seen in the presence in the midrib of some scattered cambium tissue. An indication of the conveyance of saline matters from soil to leaf is the presence of crystals, which are composed of calcium oxalate in special cells of the latter. This compound occurs in the cells of seedlings and growing parts in needle-shaped crystals ("raphides") belonging to the oblique system and having the composition $\text{CaC}_2\text{O}_4 + 2\text{H}_2\text{O}$, and is then termed "primary"; but in leaves it is mostly in

* Quoted in Lord Avebury's "Life-History of British Flowering Plants" (1905), p. 370.

† I prefer to use this term in the wider sense of general physiologists, rather than as a mere synonym for the chlorophyllian function.

single prisms or octahedra of the pyramidal system, with the composition $\text{CaC}_2\text{O}_4 + 6\text{H}_2\text{O}$; and it was long ago suggested that calcium sulphate in the soil was the source, or a source, of the sulphur requisite to the building up of protoplasm, and that it was liberated as sulphuric acid (H_2SO_4), an unstable compound in the presence of organic matter—by the union of the calcium with oxalic acid. The neutralisation of this acid would also be a physiological advantage. These crystals are thrown off unchanged in the autumn leaves.

The most striking function of green leaves—one which they share, however, with young green stems—is that of the fixation of the carbon of atmospheric carbon-dioxide, in the form of carbo-hydrate. As this process only occurs in the presence of the green colouring-matter known as “chlorophyll,” and under the influence of light of some intensity, it has been termed the “chlorophyllian function” or “photosynthesis.” According, however, to the recently published experiments of Messrs. Usher and Priestley,* it appears that dead, *i.e.*, boiled, chlorophyll is capable, under the stimulus of such light, of decomposing or “photolysing” the carbonic acid, and that the subsequent synthesis of the carbo-hydrate is the work of protoplasm and is independent alike of chlorophyll and of light. These authors seem to have demonstrated that the products of the chlorophyllian photolysis are formaldehyde (formalin) and hydrogen-peroxide, and that the former is rapidly polymerised into a polyose sugar by the living protoplasm, while the latter is decomposed by a special “enzyme” or “unorganised ferment” with liberation of oxygen.†



It had previously been shown by Messrs. Brown and Morris‡ that one of the cane-sugars is the first to be formed, and that

* “Proc. Royal Soc.,” 1906, Series B., 77, p. 369.

† R. Meldola, “The Living Organism as a Chemical Agency,” a Presidential address delivered March 30th, 1906 (“Trans. Chem. Soc.,” 1906, vol. 89), which reached me too late for fuller treatment, discusses the whole question, and the further problem of the formation of nitrogenous compounds.

‡ “Trans. Chem. Soc.,” 1890, vol. lvii., p. 458, and 1893, vol. lxi., p. 604.

starch, long known as the first visible result, is merely a temporary resting stage of carbo-hydrate when apparently its formation outstrips its rate of transference from the cells in which it originates.

The palisade-cells, with their crowded chloroplastids exposed to the light, are then the main laboratories of the plant, and from them the products of assimilation pass as glucose and other soluble substances into the phloem elements of the veins, and so to any growing parts (buds or cambium) or the reservoirs of food-substances such as the sapwood or the young seeds.

Professor Wolff (*loc. cit.*) gives the following ash-analyses of beech leaves in summer and in autumn :—

	Percentage of Ash.	Potash.	Soda.	Magnesia.	Lime.	Phosphorus pentoxide.	Sulphur trioxide.	Silica.	Chlorine.
Summer.	4·83	18·5	1·8	8·6	36·5	7·8	3·1	15·2	1·2
Autumn.	6·75	5·2	0·6	6·0	44·9	4·2	3·7	33·9	0·4

Perhaps, however, Ebermayer's more recent estimate of the annual demands of a crop of pure beech for the formation of its wood, stated approximately in lbs. avoirdupois per acre, is of greater practical utility. He estimates that a crop 90, 100, and 140 years old forms from 30 to 49 lbs. of ash, containing $6\frac{1}{2}$ to $8\frac{1}{2}$ lbs. of potash, 15 to 20 lbs. of lime, and $2\frac{1}{2}$ to $4\frac{1}{2}$ lbs. of phosphoric acid.*

If anything could surpass the beauty of the beech in spring, it would be the beech in early autumn. William Gilpin, who did so much to create a taste for the beauties of forest scenery, was strangely prejudiced against the beech, and yet even he has to admit that then it is admirable. "Sometimes," he says. "it is dressed in modest brown, but generally in glowing orange ; and, in both dresses, its harmony with the grove is pleasing. About the end of September, when the leaf begins to change, it makes a happy contrast with the oak, whose foliage is yet verdant."

* "Forstlich-naturwissenschaftliche Zeitschrift," 1893, pp. 225—226.

The fall of the leaf is brought about in the usual manner, by the spreading of the periderm through the outer tissues at the base of the leaf-stalk, thus arresting all communication between the epidermal and hypodermal (mesophyll and cortex) cellular tissues of leaf and stem. This "absciss layer" then presses upon the vascular tissue of the leaf-stalk and, closing its cavities, stops the flow of watery sap into, and of "elaborated" sap out of, the leaf. The leaf then dies, a slight breeze is sufficient to break through the three "leaf-trace bundles," leaving them as minute projecting points on the small elliptical cushion of newly-formed cork that forms the leaf-scar, and the crisp copper-like leaf is added to the thick carpet at the foot of the tree, through which grasses and most herbaceous plants fail to penetrate.

While seedling beech trees are very intolerant of the pruning-knife, when older this species stands clipping in a hedge-row better than most trees, and when so trimmed, or after recent pollarding, it retains its withered leaves through the winter. If, as in the hornbeams and some few beeches in Epping Forest, pollarding be abandoned, the trees gradually regain their entirely deciduous habit. A similar retention of the withered leaves occurs if a branch be broken half through during the summer. It looks as if the need for the formation of "callus," or healing periderm over wounds or cut surfaces, prevented the tree from exercising the full activity of its absciss layers, a curious exemplification of that law of "balance-ment of growth" long ago stated by Aristotle,*

ἅμα δὲ τὴν αὐτὴν ὑπεροχὴν εἰς πολλοὺς τόπους ἀδυνατεῖ διανέμειν ἡ φύσις,

"Nature is unable to spend in many directions at once."

The chief fungus on the leaves of beech is *Phyllactinia suffulta* Sacc., which produces white spots.†

The larvæ of the hop-dog, or beech spinner tussock moth (*Dasychira puäibunda*), to a less extent those of the black arches (*Liparis monacha*), the cockchafer (*Melolontha vulgaris*), the black beech-hopping beetle (*Orchestes fagi*) and some other beetles, eat the buds and young foliage of the beech. The tussock moth

* "De Partibus Animalium," ii., 9.

† George Massee, "Text-book of Plant Diseases," p. 98, fig. 26.

deposits her eggs by the hundred on the smooth bark within ten feet of the ground at the end of May, when they can be killed by tar. The caterpillars appear about a month later and descend the trees to pupate at the end of September. They chiefly attack older trees on inferior soil, and a plague of them seldom lasts more than two years in succession; but during that time they may seriously check the formation of new wood. Insectivorous birds are useful in reducing their numbers. The black arches moth always lays its eggs beneath scales of bark and, therefore, breeds more commonly on the spruce. The cockchafer or May-bug sometimes swarms among young beech leaves, and the damage done by it seriously reduces the growth of wood and causes the tree to draw upon its reserves of food-material to put out a second crop of leaves. In German forests the beetle is largely collected, and some experiments have shown that it forms, with meal, a valuable food for pigs. The hopping beetle is a tiny weevil only one-tenth of an inch long, the female laying her eggs singly under the epidermis near the midrib on the under surface of beech leaves just as they leave the bud. Two or three weeks later the larvæ mine through the mesophyll, making white tracks which soon turn brown, so that the leaves look as if nipped by frost. In June the mature beetles appear and feed on the leaves and nut-cupules until they descend to hibernate among the dead leaves on the ground. Hopping, like fleas, in millions, from tree to tree, they certainly do considerable damage. In mixed forests, where insectivorous birds are always more plentiful, their attacks are less serious.*

THE FLOWER.

Though coppice-shoots flower when thirty or thirty-five years of age, isolated trees do not as a rule flower until they are forty or fifty, and trees in close order not until they are from sixty to eighty years of age. Heavy crops of blossom and fruit occur every three, five, six, ten, twelve or even twenty years according as we approach the northern limit of the geographical area of the species, *i.e.*, 57 degrees N. lat. in Scotland,

* Fürst, "The Protection of Woodlands" (trans. Nisbet), 1893, pp. 204-206, 169-173, 159-164, 196-197.

Christiania, Dantzic, Warsaw and Northern China. When, however, these heavy crops occur at long intervals, the intermediate minor crops occur frequently and have a considerable yield.

As is so commonly the case among our catkin-bearing trees, the inconspicuous flowers of which depend for their pollination upon the wind, the blossoms of the beech are slightly "precocious," appearing, that is, a little before the unfolding of the leaves, in April or the beginning of May. In this way the pollen can be blown from tree to tree, unimpeded by leaves. As is the rule among the Cupuliferæ or catkin-bearing trees, from which large group the oaks and beeches are now commonly separated as the order Fagaceæ, flowers of both sexes occur on the same tree, though in distinct clusters: they are, that is, what is termed "monoecious."

The male catkin hangs by a long (1 to 2 inches) stalk or peduncle from the axil of one of the lower leaves on a shoot. Its cluster of flowers is globular, or "capitulate," and comprises from six to sixteen closely packed flowers which are developed in a "dichasial cyme," the central flower forming first and then one on each side of it, and then one on each side of each of these, and so on. Each flower is slightly stalked and has a bell-shaped perianth divided above into from four to nine segments which are nearly equal and are hairy. They each enclose, or rather surround, from six to twenty stamens. The stamens have long, slender filaments, free from one another and projecting considerably beyond the segments of the perianth. The anthers are oval, attached by their base, and yellow; but the perianth is of a reddish-purple. As is the rule among Angiosperms, the anthers form four pollen-sacs each, which, by the absorption of the intervening tissue, form, before ripening, two chambers, one in each lateral lobe of the anther. These burst longitudinally and outwards.

The female inflorescences are borne on shorter erect axes in the axils of the leaves of the apical portion of the shoot of the same year. They each consist of two, or occasionally three, erect flowers, *i.e.*, a central one and two lateral ones, or the latter only, the development being "dichasially cymose." They are surrounded by an accrescent cupule,

which, growing at first, like most leaves, faster on its under surfaces, soon encloses the newly pollinated flowers. Its growth is later on reversed in direction and its four leaf-like lobes then diverge and recurve, at the same time becoming hard and leathery. The exterior of the cupule (formerly known as the "outer calyx") is furnished with numerous long soft outgrowths, which also recurve and harden later. Development and comparative anatomy suggest the four-lobed cupule to be rather axial in origin, these "bristles" representing leaves. Each of the enclosed flowers has an adherent perianth, surmounted by an irregular torn "limb," the "inner calyx" of old anthers, which persists in a withered state ("marcescent") in the fruit stage. The ovary of each flower, which, owing to this "adhesion" of the perianth, is technically termed "inferior," is three-sided and internally three-chambered, and is surmounted by a style dividing into three rather long recurving acute, downy stigmatic lobes. Each chamber of the ovary contains two suspended ovules which are so reversed or bent backward on the threads ("funicles") by which they are attached that their micropyles come directly under the lower end of the canal of the style. This arrangement is termed "anatropous," and facilitates the passage of the pollen-tube into the micropyle. Yet, as we have already seen, only one of the six ovules usually forms a seed. The cupule is green in May, but changes to a dark brown in October, when the enclosed three-edged nuts have acquired their glossy chestnut hue.

The male catkins fall in May, as soon as they have discharged their pollen; and at Claremont in Surrey, and elsewhere where the tree is abundant, gardeners collect them as a soft scentless material in which to pack fruit.

FUNGOIDAL ENEMIES, &c.

Several fungi interesting as articles of food or otherwise are intimately associated with the beech, living among its fallen leaves or its roots, though there is in most cases no evidence of any parasitical attachment. Such are the morel (*Morchella esculenta* D C.) in spring, and *Helvella crispa* Fr. in autumn, and the truffle (*Tuber aestivum* L.) in October.

Helotium fructigenum Rehm. and *Sphæria carpophila* Pers., occurring as they do on the "mast," or cupule, after it has fallen, are probably not harmful; and *Hydnum diversidens* Fr., and perhaps *H. coralloides* Scop. are apparently rather saprophytic, occurring on dead stumps, than parasitic.

Professor Marshall Ward, however, has cautioned us as to *Agaricus melleus* (*Armillaria mellea* Vahl.), which is often found on rotten stumps, but is undoubtedly a dangerously destructive parasite to conifers.* No doubt the white spores dispersed from the gills of this tawny toadstool as it grows in clusters in September and October serve to propagate the fungus; but more serious are the attacks made by its long branching purple-black "rhizomorphs," or mycelial cords, which spread through the surface soil, penetrate the cortical tissue of living roots and extend through the cambium and medullary rays and into the wood, discolouring, delignifying and destroying all they traverse.

In the same work the Cambridge Professor fully describes *Phytophthora Fagi*, R. Hrtg., the mould which causes the "damping-off," to which we have alluded, in the seedlings.† This disease generally shows itself in the blackening and rotting or shrivelling of the "hypocotyledonary axis," "tigellus," or, as it is commonly called, the "collar," just below the cotyledons; but at other times the cotyledons and first true leaves appear thus blackened. In a rainy May or June the disease spreads rapidly over the seed-beds; and it will reappear in the same beds in a following year. Microscopic examination of the diseased seedlings shows them to be filled with the slender "hyphæ" or threads of this mould, which send minute suckers through the cell-walls, eating their way by a ferment or "enzyme," produced and excreted by their protoplasm. The fungus-hyphæ pierce the epidermis and their ends then swell into spore-like reproductive bodies known as "conidia." Each of these little granules, readily carried by wind, may infect a new plant as it bursts on germination, liberating more than a score of minute protoplasmic bodies (zoospores), which swim

* Marshall Ward, "Timber, and some of its Diseases" (1889), pp. 155—162.

† *Op. cit.*, pp. 271—284.

about in any drop of water and then start a new leaf-penetrating fungus. A little later the fungus forms an "oospore," or larger rounded termination to one of its branches, which is fertilised by a smaller branch or "antheridium" originating below it, and this fertilised oospore acquires a thick coat and is capable of living in a dormant condition for a year or more before germinating, which the conidia are not. It is, therefore, these "resting spores" which infest the seed-bed in the second year.

This fungus has no serious effect on plants two years old. It is in its fatal action on full-grown trees that *Coccus fagi* far surpasses all other pests at the present time.

11, Onslow Road,

G. S. BOULGER.

Richmond, Surrey.

APPENDIX.

THE FELTED BEECH COCCUS (*Coccus fagi* Bärensp.).

Distribution.

This insect confines its attacks exclusively to the beech (*Fagus sylvatica*), and is one of the most destructive pests against which the arboriculturist has to contend. It is widely distributed throughout England, and has occurred in many parts of Scotland. It is common in the counties of Flint and Denbigh in North Wales; while in Ireland it has, so far, been recorded from one locality only. Its attacks are often restricted to a comparatively small area, or even to single isolated trees, this being especially noticeable where the tree-trunks are sheltered from the prevailing winds.

Signs of Infestation.

Owing to the whiteness of the felted covering with which the female protects its body, and also to its exposed position upon the trunks and main branches of the trees, the beech coccus is at all times a conspicuous species, and more especially so when the white secretionary coverings unite and almost completely cover the bark of the tree.

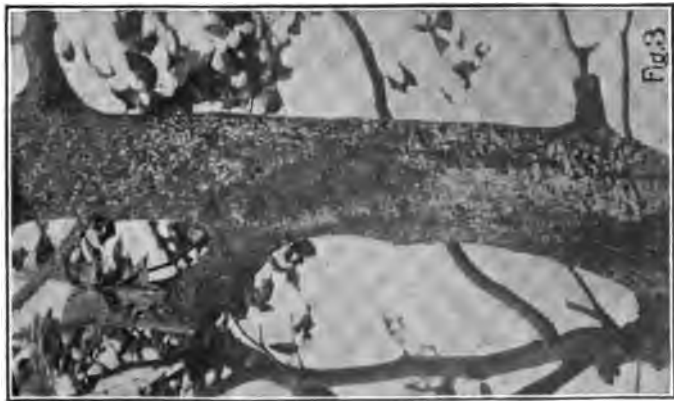


FIG. 30.

Figs. 30 32.—BEECH ATTACKED BY COCCUS FAGI. (By kind permission of the Board of Agriculture and Fisheries.)

Fig. 30.—Main trunk of young beech badly infected with coccus. Fig. 31.—Young beech, which was similarly infected to that shown in Fig. 30, 21 months after treatment with insecticide No. 2; now free from the pest. Fig. 32.—Upper branches of very old beech killed by the coccus; the bark has peeled off in patches.



FIG. 31.



FIG. 32.

Young and old trees are alike attacked; and the insects usually confine themselves to the main trunk and larger branches; but the smaller branches, especially those of young trees, are sometimes infected to a serious extent. Where the infected trees are growing in exposed situations the insects almost invariably select the sheltered side of the tree. Many badly infected trees which have been under close observation for the last sixteen years are still apparently vigorous and healthy, while others have been totally destroyed. The first sign of decay is usually seen in the foliage, which becomes discoloured and sparse or thin, accompanied by the death of the smaller branches; this is followed by the death of the larger branches and, finally, the tree trunk; while the bark peels off from the branches and falls away. Whether the work of destruction is aided by the joint action of a bacterial or fungoid disease is not at present known, but it is probable that such is the case, otherwise it is difficult to understand how so many badly infected trees withstand the attacks of the insects for such long periods without showing any evident signs of decay.

Description and Life-History.

The beech coccus belongs to the generally destructive family of scale insects (*Coccidæ*). The adult female is of a lemon-yellow colour, and measures about one-twenty-fifth of an inch in length. It is both wingless and legless; is somewhat hemispherical in shape, being flattish beneath and highly convex above; and to the naked eye or under low magnifying power it appears like a small yellow egg. The mouth organs are placed on the underside of the body, and are composed chiefly of three hair-like appendages which in life are united to form a long sucking tube; with this slender apparatus the insect pierces the bark and sucks up the juices of the tree. She has no power of locomotion, remaining stationary throughout life, anchored to the tree by her mouth organs, motionless, and apparently senseless. Almost immediately after leaving the egg she covers her body with the white felted secretion, composed of fine filaments of wax, which gradually thickens and

forms an excellent protection to her body, being practically impervious to rain. Within this covering the insect lives, lays her eggs, and dies.

The *larvæ*, or "lice," as they are sometimes called, are very tiny active creatures, and are scarcely visible to the naked eye. They possess three pairs of legs and a pair of horns (*antennæ*), and like their parents are of a yellow colour. Although they can and do travel over the bark of the tree, they usually settle down in the immediate neighbourhood of the parent, the majority working their way under the bodies of their dying or dead parents, taking up their positions, by preference, in the deepest parts of the fissures in the bark, where they remain for the rest of their lives pumping up the juices of the tree. Each individual protects its body with secretion, which adds to that already secreted above them by the insects of the previous generations; thus the secretion gradually thickens and spreads over the tree-trunk, forming a more or less continuous mass, often attaining a considerable thickness. Larvæ which wander over the bark are liable to be borne away by the wind or, inadvertently, by birds and insects, and this is undoubtedly the means by which fresh colonies are started.

The *male* is unknown in any stage, the females being parthenogenetic, reproducing their species without the intervention of the opposite sex.

Many of our indigenous scale insects are subject to the attacks of minute parasitic insects related to the wasp family; but, so far, the beech coccus has proved immune from their attacks. Birds do not appear to feed upon them.

Treatment.

Owing to the comparatively smooth nature of the bark of the beech, and also to the fact that the insects are often confined to the trunk and main branches, this pest is more easily accessible for treatment with insecticides than are many other pests. But they are so well protected by their waxy coverings that the application of an insecticide must be carried out in a thorough manner or the result will be anything but satisfactory. The three formulas given below have proved to be thoroughly

efficient in destroying this pest when applied according to instructions :—

1. *Paraffin Emulsion*.—This should be prepared in the following way :—Mix equal proportions of soft soap dissolved in boiling water, and paraffin, and churn them up by means of a force-pump or syringe. When required for use add twenty times its bulk of water, and again churn.

2. *Paraffin Emulsion with Sulphur and Turpentine added*. *—Take about half a gallon of soft water, boil and dissolve about 1 lb. of common soap, add a handful of sulphur and a pint of paraffin, and about the same quantity of turpentine. Add about four gallons of soft water to this mixture and churn well together, as recommended above.

3. *Caustic Alkali Wash*.—Dissolve 1 lb. of commercial caustic soda in water, then 1 lb. of crude potash or pearl ash in water. When both have been dissolved mix the two well together ; then add $\frac{3}{4}$ lb. of soft soap, stir well and add sufficient water to make up to ten gallons. Caution.—Do not mix in painted vessels of any kind.

Formulas Nos. 1 and 2 should be applied with a good stiff scrubbing-brush, one having the bristles also set at the end being the most serviceable. Care should be taken to scrub the mixture well into the crevices and bifurcations of the branches and to break up the white coverings of the insects as much as possible. Nos. 1 and 2 may be applied at any time between September and the first week in April.

The caustic alkali formula is essentially a winter wash, but may also be applied in early spring. It is usually applied with a spray pump or syringe, and is particularly useful in treating the smaller branches of trees. Two or three sprayings at intervals of two or three days are necessary. This wash has a burning effect upon the hands of the operator, and care must be taken in employing it. Close-fitting rubber gloves may be worn to protect the hands ; and a rubber washer or flange, about 2 in. wide, should be fitted to the tube of the sprayer or syringe to prevent the wash running down to the hands of the operator.

* Gillander's Mixture : "Trans. Manchester Microscopical Soc.," 1898. Separate reprint, p. 12.

Reviews and Notices of Books.

“THE LAWS OF PRIVATE FOREST PROPERTY.”*

This very useful treatise begins by stating that the French Forest Code of 1827 already shows signs of old age ; it is but a coppice shoot from a felled tree, the Ordonnance of 1669. Modern utilisation of wood for papermaking has taken the place of wood for shipbuilding for which it was largely used in the early part of the nineteenth century, while new special laws, such as that of April 4th, 1882, provides for expropriation of private land when its misuse leads to dangers to other properties and to the degradation of the soil.

Another proof of the insufficiency of the code, is that other nations having adopted it have been obliged to extend it, in order to take measures to prevent the disafforestation of private lands, which constitutes a menacing danger in Europe. The revision of the law is therefore called for, and the author here gives an account of the restrictions imposed on private forest property by the laws of the chief countries of Central Europe. Mr. Madelin could have extended the question by including an account of forest legislation in British India, the United States of America and Canada, which he hopes to utilise in a future volume, but at present has limited the subject as stated above.

The limitations to rights in private forests which are dealt with come under the following heads : Supply of wood for naval construction ; Obligations on frontier forests for defensive purposes and for road construction ; Regulation of floating wood on rivers ; Prevention of forest fires, especially in the Maures and Esterel ; Prevention of damage by shifting sand ; Limitation of the right of clearing forests—this subject occupies several chapters ; Protection afforded to private forests by law. Five chapters deal with forest legislation external to France, and the last chapter gives the conclusions of the author.

* “ Les restrictions légales au droit de propriété forestière privée en France, en Allemagne, en Autriche, en Hongrie et en Suisse. Par Jules Madelin, Docteur en droit, Inspecteur-adjoint des Eaux et Forêts.” Paris, Arthur Rousseau, Editeur, 14, Rue Soufflot, 1905 : 222 pages, with index.

Private forests in France extend over about 16,000,000 acres about 7 of the total forest area of the country, while since 1860, in districts where State assistance was given to the planting of wasteland, only 100,000 acres have been planted, while 350,000 acres of forest have been cleared. Private initiative however, retrieved matters in Gascony, Solome and Champagne, where, since 1800, over 2,500,000 acres of private forests have been planted. Although the area of private forests is maintained, they are often so badly managed that the soil in them is steadily deteriorating. To remedy this evil Mr. Madelin wishes to establish perimeters of protection in certain districts, not for compelling owners to plant wasteland, but to manage their existing forests in accordance with rational sylviculture. This, in view of the obligatory subdivision of property in France, can be done only by forming associations, so that certain private forest woodlands should be united for management by State forest officials, and the produce subdivided among the owners.

It also appears that there are about 15,000,000 acres of waste lands in France, and the author suggests that the State should purchase all the waste land that can produce trees and plant it for the benefit of future generations.

"ARBORETUM DE TERVUEREN." *

Mr. C. Bommer, who is an honorary member of the Royal English Arboreal Society, has kindly sent a copy of the description he has written of the arboretum at Tervueren, near Brussels. This forms a very neat volume of 211 pages with some excellent full-page illustrations, maps and plans.

The arboretum was formed by the King of the Belgians, and in December, 1904, contained 206 species, 90 conifers and 116 broad-leaved trees, altogether 6,000 trees. They are arranged in little groups together with the principal shrubs and herbaceous plants that accompany them in their native habitats,

* "Types de Forêts des régions tempérées. C. Bommer, Professeur de l'Université de Bruxelles, Membre du Conseil supérieur des forêts, Conservateur au Jardin Botanique de l'Etat. Published by F. and L. Tervue, 115, Rue de Flandre, Brussels, 1905.

being from all the temperate regions of the earth. The object in view is to afford a splendid illustration serving for the study of plant-geography and also as a guide for the planting of exotic species in Belgium. About 70 acres are laid out in accordance with the geographic localities of the trees. Two main sections form the old and new worlds respectively, while these are subdivided into smaller geographical regions and districts. Full notes are given in the descriptions of the species, as to their natural habitats and their success or otherwise in Europe.

“JOURNAL OF ECONOMIC BIOLOGY.”*

The April number of this journal contains an illustrated article by E. R. Burdon, of Cambridge University, on the spruce-gall and larch-blight caused by various species of chermes, and this very clearly explains the life-history of these insects. Another paper, by Herbert Stone, on the collection of timber specimens gives some excellent hints to colonists and explorers. There is also a paper by F. V. Theobald, on new hemipterous fruit pests in Britain, and a review of Brandis' “Indian Trees” by W. R. Fisher.

QUARTERLY BULLETIN OF THE IMPERIAL INSTITUTE, No. 1, 1907.

Among other interesting papers, the following are noted, as of importance to foresters :—

RECENT DEVELOPMENTS IN PORTUGUESE EAST AFRICA.

A preliminary list of plants indigenous to the country or thoroughly acclimatised, including valuable timber trees and plants yielding fibres, rubber, tanning materials, gums, resins, &c., has been published in the Proceedings of the Botanical Society of Edinburgh, 1906, p. 167.

Various native species of *Landolphia* yield rubber, but the

* Edited by W. E. Collinge; Dulau & Co., 37, Soho Square, London, W.

cultivation of the Ceara rubber tree (*Manihot Glaziovii*) has not proved encouraging. The most important timber trees for export from Mozambique are ironwood, ebony (*Dalbergia Melanoylon*) and mahogany. The branches of *Millettia caffra* are used for walking-sticks. Hard yellow resins from certain native trees are exported to France, where they are worth up to 10d. per lb.

The most important tanning materials are obtained from the bark of the Mangroves, *Rhizophora mucronata* and *R. racemosa*, *Cerriops candollicura* and *Brugueira gymnorhiza*.

Another valuable paper in the "Bulletin" is on the hardwoods of Western Australia, where there are still 31,850 square miles of merchantable timber, about 20,000 square miles of which is chiefly Jarrah and Wandoo (white gum). The scientific names of these trees are *Eucalyptus marginata* and *E. redunca*, and the latter, weighing up to 70 lb. per foot when fully seasoned, is considered equal to Jarrah for railway-sleepers. A useful table showing the comparative strength of the different species of timbers is given, full details being given in two important publications recently issued by the Government of Western Australia, entitled—(1) "Notes on Timbers of Western Australia suitable for Railways, &c."; (2) "The Physical Characteristics of the Hardwoods of Western Australia," by G. A. Julius.

The former embodies some of the conclusions of the State Royal Commission on Forestry, 1904, and contains a map showing the situation of the principal timber forests.

"THE INDIAN FORESTER."

The February number of the *Indian Forester* contains a paper by Mr. R. S. Pearson, of the I.F.S., on "The Level of Subsoil Waters with regard to Forests." Mr. Ototzky in 1895, and Mr. Tolsky in 1901—2, in the forests of Chipoff, and the Black Forest, Kherson, and Mr. Henry, of the Nancy Forest School, in 1900—2, in the Mondon forest (Meurthe-et-Moselle), carried out detailed observations, which prove that the subsoil level of water is 12 metres deeper in the Chipoff forest than outside the forest, 4 to 5 metres deeper in the Black Forest, and 1·15 metres deeper in the Mondon forest.

Mr. Pearson has made similar observations in the Mohulia forest, Pauch Mahals, India, from 1904 to 1906, readings being taken every month for twenty-five months. The table given shows that the average level is 4·74 metres lower in the forest than outside, a figure which stands between those given by Mr. Ototzky for the dry steppes of Russia and those given by Mr. Tolsky for the moister climate near St. Petersburg. In a low rainfall area the difference of levels is also greater in India than where the rainfall is more abundant. Mr. Pearson's paper is illustrated by excellent diagrams.

There is an excellently illustrated paper by Mr. B. O. Coventry, on the irrigated Changa-Manga plantation in the Punjab, showing the conversion of an extensive arid area of waste land into a thriving wood of *Dalbergia Sissoo* and mulberry, worked as coppice-with-standards, and yielding about 2,000 cubic feet per acre, with a fifteen years rotation.

There are several other interesting papers, including a review of the forest administration of British India for 1904—5. The department now controls 24·1 per cent. of the area of the country. Most remarkable frosts in Northern and Central India were experienced in February, 1905, and it will be many years before the forests recover from this severe visitation. The surplus of revenue over expenditure was the equivalent in rupees of £1,095,450.

Official Papers.

R. E. A. S. RAILWAY-RATE COMMITTEE.

SECOND REPORT.

March 1st, 1906.

Your Committee has further inquired into the subject of the charges of English railway companies for traffic in English timber, and it appears evident that the common rate is about 2½d. per ton per mile, with addition for terminal services, and that there is throughout Britain a differentiation in favour of foreign timber.

When we inquire how the same subject is dealt with on the Continent, although there native grown timber is of higher value than in England, the charges are much less, as shown by the following rates:—

Per ton per mile (in pence).				
62 miles or 100 kilometres.				
England	...	...	...	2·5
Belgium	...	...	...	·6
France	...	...	...	·7
Germany	...	...	...	·57

For greater distances, the disparity of rate, English and foreign, is more marked.

Such a disparity between British and Continental rates suggests the question, "Do these higher rates generally apply to all railway traffic in this country?" Apparently not, as the charges for carriage on corn per ton per mile differ but little in English and Continental countries, as will be seen from the following:—

Per ton per mile (in pence).				
per 100 kilometres, or 62 miles.				
In England	...	1½	(One and one-third pence.)	
Belgium ...	...	1		
France ...	...	1		
Germany...	...	1		

Therefore it will be seen that the application of heavier rates throughout Britain is not general.

Again, on the other hand, in some of the Continental countries a process is adopted which appears to be exactly the reverse of that which obtains in Britain. Whilst here timber in the form in which foreign supplies come to hand is charged at a less rate than native-grown timber, in Continental countries it is charged at a higher rate.

In Germany, the charge for carrying foreign timber is more, and the charge for carrying logs of native timber or the raw material is less, presumably because it is raw material and homegrown, and to encourage and cultivate the home country's produce.

British railway companies apparently do make lower rates for some articles of less value, as, for instance, coke, not being of as great value, is not charged for at so much as coal.

However, in timber the application of the principle of making lower rates of carriage for timber of lower value does not appear to be a process adopted by the English railway companies in any respect, although value is a very important factor in the case. It must be readily appreciated that timber which is worth 7s. to 10s. per foot cube can afford a heavier charge of carriage than that which costs 1s. per foot cube.

The Committee has considered a case where timber with a cost of only 1s. per foot cube required to bear a railway company's charge of 7*d.* per foot cube to get it to the nearest market. The following is a simple instance in review of rates and their relation to value :—

The rate from Paddington to Worcester

On timber (English) value £2, tape			
over bark, 144 divisor...	...	...	23s. 6 <i>d.</i> per ton.
On grain value, say, £10	...	...	14s. 10 <i>d.</i>
On coke (Worcester to Paddington)			
value, say, £1	...	...	5s. 9 <i>d.</i>
On foreign timber, deals, boards,			
battens value, say, £14	...	...	14s. 10 <i>d.</i>

It will therefore be seen that the railway companies' method of approaching this subject is a disadvantageous one for the landowner or grower of this country.

The subject is a very important one as regards the employment of labour.

The Report of the Departmental Committee on British Forestry, 1902, said that land quite capable of producing high class timber employs only one shepherd per 1,000 acres, if used as sheep-run, whilst the same ground, if planted for timber growing, gives employment to at least 10 men per 1,000 acres.

We find from inquiry at the Board of Agriculture and from Mr. G. Huffel's "Economie Forestière" that 10s. per acre per annum is the common outlay in forest labour on the Continent.

Perhaps in this connection of labour a greater benefit arises even than the actual wage, namely, the time when the labour

is called for. Felling and planting are mainly winter occupations. Agricultural labour can therefore be profitably kept throughout the year, thus increasing the wage while equalising and economising the employment.

The native timber which is now coming into the market was planted at a time when timber possessed a much higher value than it does now. This was no doubt partly due to the duty on foreign timber, but the reduction in value has been principally on account of the competition of foreign timber, and the extra cost of hauling British.

The general tariff of charges made by the railway companies was arranged at a time when native timber possessed a higher value; now that home products have become so reduced in price and the competition of foreign timber is so keen, it would appear necessary to reconsider and reduce the system of railway charges to meet the altered circumstances.

We have to thank Mr. Couttolenc, Inspecteur Des Eaux et Forêts, Mr. Cairfax Scott and Mr. C. H. Powis for serviceable information.

W. R. FISHER, *Chairman*.

At the meeting of the committee, April 5th, 1907, it was decided to obtain the most striking instances of cases of excessive railway rates, in order to provide the committee with information for publishing in the Society's paper, or for taking any further action.

In the meantime we publish the following, which will speak for itself:—

HIGH WYCOMBE, BUCKS,
March 13th, 1907.

GENTLEMEN,—In reply to your favour of the 9th, *re* haulage of timber, we bought some 400 trees on the Milton Abbas estate some few years back. We hauled a quantity of it direct home to Wycombe, about 100 miles each way, but as we could do only one journey a week (there and back) we could not, of course, get the timber home in anything like a reasonable time.

We removed the rest by traction engine into Dorchester

Station, a distance of some 12 miles. It would have cost us 4*d.* per foot to do that had we employed anyone else.

We asked the Great Western Railway for a special rate for 1,000 tons from Dorchester to Wycombe, and they charged us 21*s.* 6*d.*, including loading, for 40 feet to the ton, a distance by rail of 139 miles.

With the rail and land charge the timber cost for carriage 10*d.* per foot; so it did not leave a big margin for the timber if the merchant is to get a profit.

The maximum charge the company could make was 20*s.* 4*d.* per ton; so you see they gave me a special rate for 1,000 tons of 9*d.* beyond what ought to have been their full charge.

These facts I did not know at the time, though I know better now, and test every rate; but we find our engine pays us better than putting timber on the rail, which we never do unless the distance is too great, and prevents us clearing in the proper time.

Yours sincerely,
(Signed) JONATHAN PLUMRIDGE & SONS, LTD.

P.S.—The railway rates kill the English timber trade. Canadian timber is brought from Liverpool to Wycombe for 17*s.* 6*d.* for 50 cubic feet. English timber would be 33*s.* for 40 feet.

It is greatly to the disadvantage of the estate owners, who get very little in many cases for their timber, owing to the cost of transit. Take the Dorchester case: the estate got about 3*d.* per foot for, say, sixty years' growth of timber; the railway company got 6½*d.* per foot for one day's transit.

Some of the big beech timber which formed a frontispiece illustration of No. 2 of the JOURNAL OF FORESTRY was removed 60 to 70 miles also by road in preference to rail.

The following form is appended with the view of obtaining from any member of the Society any good instance which may recently have come before his notice. Communications should be addressed to Sir Hugh Beevor, Bart., Croxley Green, R.S.O., Herts.

CASES OF EXCESSIVE RAILWAY RATES.

Name of Railway Company

Loading Place for Goods

Destination of Goods.....

Railway Rate.....

State whether Measurement or Actual Weight.....

Remarks.....

H. J. ELWES,
Chairman.

IRISH FORESTRY SOCIETY.

ANNUAL MEETING.

ON April 18th, the fifth annual meeting of the Irish Forestry Society was held in the Oak Room of the Mansion House. The chair was occupied by the Right Hon. Lord Castletown, of Upper Ossory, President of the Society, and there was a good attendance.

The following letters of regret were received in reply to invitations :—

From Lord POWERSCOURT :—"I hope you will convey to your Committee how sorry I am to be unable to be present at their meeting on April 18th, owing to my absence from home on that date."

From Lord ARDILAUN :—"I regret that a previous engagement prevents me accepting the invitation of the Irish Forestry Society, as I should have liked to call attention to the fact that a Government Department is busily engaged in deforesting Ireland by selling and cutting all standing timbers

on estates sold to it, and what escapes this Government destruction is duly effected by the purchasing tenant."

From the Earl of DROGHEDA :—" I am afraid I shall not be able to attend the Forestry Society's meeting on the 18th inst., but I wish the attendance may be a good one, and that something in the way of monetary assistance may be obtained from the Government. I feel strongly that steps should be taken to supply the loss of trees blown down in the great storm of February, 1903, and the reckless cutting of timber on bought-out farms. The wholesale loss of timber will not only create a want of timber itself before long, but may lead to a recurrence of droughts which do not suit the Irish soil. I have planted over 50,000 trees since February, 1903, and hope to plant 21,000 more this autumn."

From Mr. H. de F. MONTGOMERY :—" I regret that I am unable to attend the annual meeting, as I should have much liked to be present, and to assist in any way I could. I planted a good many acres of my own land this winter, and hope the results may be such as to encourage others to follow my example."

From Mr. C. B. M. CHAMBRE :—" I regret I shall not be able to attend the meeting of the Irish Forestry Society on the 18th inst., but it may be of interest to others to know what has been done in this neighbourhood. Three years ago we established St. Patrick's Day as Arbor Day. The movement the first year was approved and assisted by the Board of Guardians. Last year the Urban Council took part, and trees were supplied and planted by the members of the Board. An Association was formed known as the Dungannon Tree Planting and Improvement Association, and steps were taken to suggest to the owners of 'waste' land to plant up these vacant spaces. This year tree planting was again carried out under the auspices of the Association, but it is more gratifying to be able to report that the suggestions of a year ago have borne fruit, and many ungainly sites are now attractive shrubberies. This latter is perhaps not quite what is aimed at by the Forestry Society, but it is in line with it. Next year it is proposed to have a Children's Day."

From Commissioner W. F. BAILEY :—" I much regret that

owing to absence on official business I shall not be able to be in Dublin on Thursday evening. This will prevent me from attending and speaking at the annual meeting of the Irish Forestry Society as you kindly asked me. I am very sorry, as I take a great interest in the subject, and hoped to have been able to be present."

From Mr. WM. FIELD, M.P.:—"I regret, as I have to cross for the amendment to the Land Bill, that I will not be present. The objects of the Society have my earnest co-operation."

Other letters of regret were received from the following:—Mr. J. Mumford, Sir Edward Carson, Mr. Chas. O'Connor, K.C.; Mr. Wm. Wilson, Mr. Thos. W. Webber, Right Hon. J. Hogg, Mr. W. Long, M.P.; Mr. L. A. Waldron, Mr. R. W. Christie, Sir T. Grattan Esmonde, Miss H. M. White, Mr. T. P. Gill, Dr. H. Buchanan Murray, Mr. A. C. Forbes.

The annual report, submitted by A. H. Walkley, secretary, is given below.

The PRESIDENT, in the course of his opening address, declared that he spoke in language of "bitter jest." Their balance-sheet was the most remarkable ever seen, for their income for the past year amounted to the huge sum of £63, while their expenditure was £73! With their income of £63, a small and rather young society was trying to induce an oblivious Government, an obdurate and unapproachable Treasury, 103 members of Parliament, the different Chief Secretaries—who were rather of an ephemeral character (laughter), just passing through the country—and last, but not least, the Department of Agriculture—they were trying to induce all these to act like statesmen and sensible beings, to act like the European Governments had acted, by starting a system of reafforestation which would pay as a matter of State improvement. He did not suppose that anything so daring or so magnificent had ever been tried before. If they had tried to do this abroad they would probably have been put in prison (laughter), or, what was much more likely, the Government of the wise and practical men would have established a State Department of Afforestation. In Ireland afforestation was feasible, the land was available for planting, and the money was almost practically earmarked for this

particular purpose. People were asking every day why were not new industries created in the country, and yet if their ideas were carried out those new industries could be created. But the sad thing was that nothing was being done because all this happened in Ireland. As far as the Government was concerned their hands were too full with other questions. The Treasury he regarded as the most heartless and cold-blooded enemy they had got, but there was still some chance of inducing them to take this question up as a matter of business, and also for the general benefit of the country. Some of the Irish members of Parliament, like Mr. Field, took a deep interest in the question, but the great majority of them, orange and green, they neglected Irish forestry. The methods and achievements of the Department of Agriculture were at present under investigation, and he would say nothing more about them than that they had missed a great opportunity of dealing with the subject. They could have done a great deal for afforestation if they had been so disposed. He felt very strongly on the question, but he had spoken in terms of bitter jest, for if one did not speak lightly and airily regarding it one would lose heart and temper altogether when brought face to face with the existing condition of things. The apathy that existed on the subject was disheartening, but there was a little light in the clouds. Arbor Day was now an established fact, and they had done other useful work. With reference to the suggestion that had been made that a certain number of people should combine and give a practical demonstration for the benefit of the Government of what might be done, he did not approve of it, because he thought they should give the Government no possible excuse for inaction in the matter. Much as he valued that suggestion, which was put forward by one of the leading newspapers of Ireland, he was afraid they must combat it. They knew perfectly well what could be done. They could prove what had been done in other countries and what could be done in this country. They should give the Government no possible excuse for sitting with folded hands, and seeing other people experimenting while they mop up the £30,000 which was due to this country for afforestation, for the next thirty or forty

years. Lord Ardilaun had sent them a very interesting communication, but what they would ask his lordship, with his personal Parliamentary influence and his influence in the Press, is to get a question asked in Parliament as to what the Department was doing. There was very great ignorance in Departmental circles as to what afforestation is, and, surely, they might ask what was being done. Then the Department referred to would at once see they were making a mistake. The Society had done an extraordinary amount of work for the time they had been in existence. They had used every effort, and had left no stone unturned to do the best for the work they had in hand. They must work away and try and get the State to realise that the work they proposed was valuable to the country, not alone in our own time, but in the time of many who would come after them (applause). He moved the adoption of the report and statement of accounts.

Mr. O. H. BRADDELL seconded the motion, and said it was sad to see the dreadful cutting down of timber in our most beautiful country, and to see how little was done to check destruction or to replace timber taken away. He was afraid there was the microbe of destruction at work in Ireland. The moment they were emancipated from the landlord the ring of the axe was heard in the land. It was to him a great trouble that trees a hundred years and more old were cut down ruthlessly and sold for firewood.

The motion was passed.

On the further motion of Mr. WALTER ACASON, seconded by Mr. F. W. D. MITCHELL, the officers and committee were elected.

Mr. CHARLES DAWSON moved:—"That whilst we shall continue to impress on all individuals connected with land the necessity of protecting existing trees and of planting new ones as sources of shelter for the homesteads, improvement of the climate, and beauty of the landscape, we are still convinced that the Government alone can carry out the afforestation of the country on a national scale, and we hereby call upon it to follow the example of most of the European States and of the British Government itself in the case of India, by at once

establishing a regular "Forestry Department" in this country, which, as in the countries mentioned, would increase the national assets, employ the people, and be a source of profit to the State."

Mr. J. SCOTT KERR seconded the motion, which was passed.

Mr. A. E. MOERAN proposed: "That four provincial organisers be appointed, one for each province in Ireland, whose duty it shall be to advance the interests of the Forestry Society in their respective provinces, by every means in their power, and who by securing a wider spread of membership, and by arousing and organising a more active interest in the objects of the Society, will greatly increase the power of the Society to carry on the work before it."

Mr. J. W. OLIVER seconded, and the resolution was passed.

On the further motion of Mr. MOERAN, it was resolved, "That the Secretary of the Royal Dublin Society be approached with a view to arranging for a forestry exhibition to be held at the Horse Show in August next, and that in view of the paramount importance of encouraging Irish wood industries, this exhibition should largely take the form of articles manufactured in Ireland from Irish grown timber."

A vote of thanks to the President, proposed by Professor HOUSTON, seconded by Mr. R. SWEETMAN, was passed with acclamation, and the proceedings terminated.

ANNUAL REPORT OF THE IRISH FORESTRY SOCIETY FOR 1906.

Although Charles Lamb reprobated the cultivation of trees only to see them "dying into desks," he might at the present day have found himself able to approve the inverted conditions which, *à posteriori*, impose on the Committee of the Irish Forestry Society a vast amount of "desk work" in the hope that it may ere long grow into trees.

For "desk work" has principally characterised the work of your Committee during the fifth year of the Society now under

review. No complaint is made that the work has been hard and prosaic, and, to outward seeming, unproductive of few striking successes, although good progress has undoubtedly been made in solid work.

Few societies in their infancy have been called upon to contend with titanic problems such as are presented by the national agrarian and economic upheaval arising from the advent of the Irish Land Act, 1903; added to which are the difficulties occasioned by the cometic flight of no less than three Chief Secretaries across the bureaucratic firmament during the five years alluded to. Again and again has the Society had to renew its efforts in approaching these custodians of the national welfare, obtaining from each in succession a ready sympathy and copious promises, which elicited hopes that were doomed to extinction with the passing of their authors.

It is earnestly to be hoped that Mr. Birrell, the present Chief Secretary, will, during his term of office, have the satisfaction of establishing on a national and permanent basis the systematic afforestation of the country, with all that that means of benefit and profit to the rising and future generations of Irishmen. There may be little doubt that a Minister whose knowledge of educational matters is so profound, will likewise not fail to take a lively interest in the Arbor Day movement instituted by the Society primarily for the purpose of enlisting the interest of the school children in trees, and their cultivation and protection.

COMMITTEE OF INQUIRY.

Early in the year this Committee appointed to inquire into the working of the Department of Agriculture, consented to receive evidence from your Society as to the state of forestry in Ireland, and proposals for its development and improvement. The Society was represented by the President, the Rt. Hon. Lord Castletown, the joint Hon. Secretary, Mr. Scott Kerr, Mr. Charles Dawson, Mr. A. E. Moeran, and Mr. T. W. Webber.

Each of these gentlemen took up a different aspect of the question, but in the aggregate they emphasised the past

inactivity of the Department with regard to forestry, although that subject had been specified in the Act as coming within their operations; the urgent need of immediate and practical steps, in order to arrest the rapid denudation of the wood lands, and the need of a Bureau of Forestry with funds and a competent staff to take over the entire management, on behalf of the State, of forestry operations.

Likewise the fact that the necessary funds were already available in the monies provided by Parliament for the operations of the Department, and also in the revenues of the Irish branch of the Department under the Commissioners of Woods and Forests; and that the waste lands were available and could at once be had by purchase or otherwise for planting. Your Committee understand that the report of the Inquiry Committee is to be published in May this year, and it will be the duty of your Committee to carefully watch the course of events in order that the recommendations and labours of your representatives may bear early fruit in the organisation of a State Department—or sub-Department—of Forestry, having a systematic and practical policy to carry out. The importance of this attitude of surveillance is profoundly increased by the imminence of certain political changes in the constitution and administration of the Irish Government—which there is every reason to believe are to be looked for. The ensuing year cannot, therefore, fail to be a time of peculiar anxiety—even if it is lightened by an element of hope—to your Committee.

DEPUTATION TO MR. BRYCE.

Reference was made in the last annual report to a deputation which was to meet Mr. Bryce, the late Chief Secretary.

The interview took place in Dublin Castle, when the Society was represented by your President, Lord Castletown; your joint Hon. Secretary, Mr. Scott Kerr, and the following gentlemen, viz.:—Mr. A. E. Moeran, Mr. Charles Dawson, Mr. Alesbury, Mr. Wm. Dick, Professor Houston, Mr. R. E. Hodson, Mr. I. A. Jones, and Mr. George Perry. Mr. T. W. Russell, M.P., had promised to attend, but at the last moment was unable to do so. Mr. Bryce evinced much interest in the

recommendations made to him, and his wide knowledge of other countries enabled him to appreciate the benefits accruing elsewhere to properly administered systems of State forests. He, however, rather hinted at difficulties that might arise with the Treasury, and with the avowed object of strengthening his hand with the Chancellor of the Exchequer, requested the deputation to obtain for him: (1st) Reliable proof that the growing of timber trees in Ireland could be profitably undertaken (emphasis was laid on the point that this must be proved, not merely asserted); and (2nd) information as to any waste untenanted lands in Ireland, which, if such a course should be decided upon, could be acquired by the Government from the owners for the purpose of planting, sufficient in extent, without undue burdens, and at a reasonable price. Your Committee, accordingly, at once prepared a circular containing a list of queries under each heading, which was issued, at considerable expense, to a large number of landowners, land agents, and others.

The answers received, when carefully summarised, sufficiently proved the first point in the affirmative; and with regard to the second query, showed that there were at least 50,000 acres at that moment available, and meeting the rather exacting conditions imposed.

A supplemental report embodying these results was sent to Mr. Bryce, but your Committee regret to have to report that apparently no action was taken by him up to the date of his relinquishing office.

ARBOR DAY.

It is gratifying to be able to report that the Arbor Day movement is rapidly spreading throughout the country. It may be well to repeat for the information of many who are not in possession of the fact that "Arbor Day" is an American importation introduced into Ireland by the Irish Forestry Society, not only on account of its own pre-eminent merits, but also on account of the influence it will have in popularising the larger national question of afforestation by the State. Thirty-five years ago the movement had its inception in the State of Nebraska, and "Arbor Day" has since become a universal

holiday throughout the United States. The tangible result there has been the planting up to date of over 600,000,000 trees, planted for the most part by individual school children. The intangible results—in exciting an interest in animate and inanimate nature; in its influence upon the national character, and in the numerous benefits it brings to a country directly and indirectly—are incalculable. Briefly stated, the proposal is that upon an appointed day—or days—in each district throughout the country the school children and others should be encouraged to plant in selected spots one tree each, which becomes the planter's special care during the year. In conjunction with the Gaelic League and other public bodies your Society has arranged to dedicate to this purpose the week commencing on the 29th October in each year.

During the year a circular was issued by the Society to all the bishops, clergy, and public bodies, urging them to organise an “Arbor Day” in their various districts. The response to this was of an eminently encouraging nature, and support has been promised from such representative bodies as the County Councils of Tipperary, Waterford, Kilkenny, Queen's County, and Wexford; also by the local governing bodies of Galway City, Togher, County Wicklow, and Skibbereen; and in Dublin a party of representative gentlemen, headed by the Lord Mayor, did honour to the occasion by planting several trees in Beresford Place, the third ceremony of the sort in the capital. From all parts of the country news has been received that the movement is receiving the support of all sections of the community, and peers, peasants, clergy, and artisans, not omitting the school children, are happily united in re-establishing Ireland's claim to be known as the “Island of Woods.”

THE ANNUAL EXCURSION.

On the 15th September, the members of the Society, with their friends, met at Powerscourt Demesne, co. Wicklow, the seat of Viscount Powerscourt, who had most kindly granted permission. The day was spent in a close and instructive scrutiny of the far-famed woods, and arboretum created by that lover of tree culture, the late peer.

In the evening the party returned to Enniskerry, where

refreshments were forthcoming, after which interesting speeches were delivered by several of the gentlemen present.

SUNDRY MATTER.

Other matters which were disposed of during the year included the adoption, in conjunction with the kindred society in England, of a QUARTERLY JOURNAL OF FORESTRY, which will be issued to the members, and, being edited and contributed to by the principal forest authorities in the United Kingdom, is bound to become the recognised authority on all arboricultural matters, and cannot fail to be a stimulus to our members. Mr. A. E. Moeran has been appointed Irish editor of the journal.

Negotiations were opened by a letter from the secretary of the committee on the unemployed, inquiring if there was any likelihood that employment could be secured in the preparation and planting of forest areas. But your Committee had to explain that, much to their regret, they were powerless to assist in the absence of any fund for the purpose, and that the matter was scarcely one they could take up in any case, as their efforts had to be confined to the duties of an advisory body.

THANKS.

The cordial thanks of your Society is gratefully recorded for the gratifying support to their work extended by the Press of every shade throughout the country, and likewise to the Lord Mayor of Dublin, not only for his personal co-operation and support in their efforts to establish "Arbor Day," but for his kindness in granting the use of the Mansion House for the annual general meeting of your body.

The financial position at the end of the year shows a small adverse balance, and the Committee would take this opportunity of urging upon all members the need of personal effort in making the Society and its work better known throughout the country, and in this way securing additional adherents.

A cash account of your receipts and disbursements duly examined and vouched by the hon. auditor, Mr. D. T. Jones, is subjoined.

J. SCOTT KERR,	} <i>Joint Honorary</i>
DAVID HOUSTON,		Secretaries.

April 6th, 1907.

THE FIRST STEP

201

THE FIRST STEP

THE FIRST STEP

THE FIRST STEP

THE FIRST STEP

ACCOUNT.

31ST DECEMBER, 1906.

1906.		£	s.	d.
Dec. 31.—By General Subscriptions...	...	54	10	4
„ „ „ Annual Excursion	...	7	2	0
„ „ Advertising in Annual Report	...	2	10	0
„ „ Balance to next Account	...	10	18	2

£75 0 6

I have examined the foregoing Account with the Books and Vouchers relating thereto, and now certify it to be correct.

DUBLIN, *April 6th*, 1907.

D. T. JONES, *Hon. Auditor.*

IRISH FORESTRY SOCIETY.

Patrons :

THE EARL OF DESART, 2 Rutland Gardens, Knightsbridge, London
 THE EARL OF DROGHEDA, Moore Abbey, Monasterevan
 LORD MONTEAGLE, K.P., 13 Cheyne Walk, London, S.W.
 LORD CASTLETOWN, Doneraile, Co. Cork
 LADY MAURICE FITZGERALD, Johnstown Castle, Co. Wexford
 THE LORD PRIMATE ARCHBISHOP OF ARMAGH, Armagh
 WILLIAM FIELD, M.P., Blackrock, Co. Dublin
 PROFESSOR SCHLICH, F.R.S., C.I.E., 29 Banbury Road, Oxford
 CAPT. E. M. COOPER, M.D., R.A.M.C., 18 Wimpole Street, London,
 S.W.
 JAMES MUNFORD, 143, Queen's Road, Westbourne Grove, Bays-
 water, W.
 MISS H. M. WHITE, Alexandra College, Dublin

President :

THE RIGHT HON. LORD CASTLETOWN, of Upper Ossory

Vice-Presidents :

THE DUKE OF ABERCORN, K.G., Hampden House, Green Street,
 London, W.
 SIR THOMAS GRATTAN ESMONDE, Bart., M.P., Ballynastragh, Gorey,
 Co. Wexford
 E. M. ARCHDALE, D.L., Riversdale, Ballycassidy, Co. Fermanagh
 H. DE F. MONTGOMERY, D.L., Blessingbourne, Fivemiletown, Co.
 Fermanagh
 C. G. GREY, M.A., J.P., 8 Lansdowne Terrace, Ballsbridge

Secretary :

A. H. WALKEY, 12 College Green, Dublin

Hon. Secretary :

J. SCOTT KERR, Bayswater Cottage, Blackrock, Cork

Hon. Treasurer :

O. H. BRADDELL, Sarnia, Eglinton Road, Donnybrook

Hon. Auditor :

D. T. JONES, Dublin

Executive Committee :

R. ANDERSON, Whitefields Lodge, Phoenix Park, Dublin
H. C. BRETT, 19 Wellington Road, Dublin
CHAS. DAWSON, 74 Northumberland Road, Dublin
WM. DICK, Belsito Lodge, Inchicore, Dublin
A. DICKSON, 61 Dawson Street, Dublin
E. GALLAGHER, 23 Bachelor's Walk, Dublin
A. GILCHRIST, Grovedale, Kilternan, Co. Dublin
W. F. GUNN, 61 Dawson Street, Dublin
C. R. HAMILTON, 40 Dominick Street, Dublin
R. E. HODSON, J.P., Coolfadda, Bandon, Co. Cork
PROFESSOR HOUSTON, Royal College of Science, Stephen's Green,
Dublin
IRETON ARTHUR JONES, Pennick's Nurseries, Delgany, Co. Wicklow
A. E. MOERAN, Palmerston House, Portumna
J. W. OLIVER, Curraravagh, Oughterard, Co. Galway
J. H. PIGOT, 17 Warrington Place, Dublin
F. POWER, 25 King Street, Waterford
D. L. RAMSEY, J.P., The Nurseries, Ballsbridge, Dublin
JAMES ROBERTSON, J.P., 22 Mary Street, Dublin
R. SWEETMAN, St. Mary's, Sandford Road, Dublin
E. H. TICKELL, Northcote, Sandford Road, Ranelagh
T. P. O'NOWLAN, M.A., 18 Lower Baggot Street, Dublin

Bankers :

THE BANK OF IRELAND

List of Members :

E. Archdale, Castle Archdale, Irvinestown, Co. Fermanagh
J. Anketell Jones, Gowran, Kilkenny
Joseph Bewley, 3 Connaught Terrace, Kingstown
E. H. Browne, Charleville Estate Office, Tullamore
J. P. Boland, M.P., 4 New Square, Lincoln's Inn, London
Stephen Brown, Ardcairn, Naas, Co. Kildare
Janssen Budgeon, Ballindoney, New Ross
W. A. Barnes, Moynalty, Kells, Co. Meath
James Brown, Ivy Bank, Donaghmore, Co. Tyrone
W. F. Bailey, 62 Harcourt Street, Dublin
Arthur Barker, Shanbally Castle, Clogheen, Cahir, Co. Tipperary
C. B. M. Chambré, Dungannon House, Dungannon, Co. Tyrone

- J. Crooks, Woodlands, Eccleston Park, Prescott, England
 T. F. Crinion, Rushwee House, Slane
 H. Campbell, T.C., Cork Hill, Dublin
 Hamilton Drummond, Ashmere, Rathgar, Co. Dublin
 Reginald Digby, J.P., Geashill Castle, King's Co.
 A. Dickson & Sons, Royal Nurseries, Newtownards, Co. Down
 J. Davidson, Estate Office, Heydon, Bridge-on-Tyne
 Walter Acaon, Shankhill, Co. Dublin
 Lord Dunleath, Ballywalter Park, Ballywalter, Co. Down
 St. Clair M. Dobbs, Glengariff Lodge, Parkmore, Co. Antrim
 Rt. Hon. Lord de Vesci, Abbeyleix, Queen's Co.
 W. H. Fennessy, Waterford
 Reginald Flower, Kylenamelly, Woodford, Co. Galway
 William Forbes, Swinton, Masham, Yorkshire
 Patrick Field, St. Columba, Ballybrack, Co. Dublin
 M. Flanagan, The National Schools, Doolin, Ennistymon
 Earl Fitzwilliam, Wentworth, Woodhouse, Rotherham, England
 S. Woulfe Flanagan, Lecarrow, Boyle
 E. J. Ffrench, St. Ann's, Donnybrook
 J. Galvin, Mount Talbot, Roscommon
 P. Garrett, 111 Seville Place, Dublin
 R. E. Hodson, J.P., Coolfadda, Bandon, Co. Cork
 A. Hade, C.E., Carlow
 A. Henry, 13 Westpark Gardens, Kew, London
 S. M. Hussy, 18 Elvaston Place, London, S.W.
 E. T. Herdman, D.L., Sion House, Strabane, Co. Tyrone
 M. A. Healy, Agher Nursery, Enfield, Co. Meath
 Sir Ed. Syngé Hutchinson, Bart., Coolmoney, Stratford-on-Slaney,
 Co. Wicklow
 Thomas Hall, Forester, Moore Abbey, Monasterevan
 S. G. J. Parker-Hutchinson, Timoney Park, Roscrea
 J. Hodge, Riverview, Newtownbarry
 Oliver Hartland, Lough Nurseries, Cork
 R. W. Hall-Dare, J.P., D.L., Newtownbarry House, Newtownbarry
 M. Hynes, 4 Casino Terrace, Malahide Road, Clontarf
 Rt. Hon. J. Hogg, Stratford, Rathgar, Dublin
 James Hogan, 15 Upper Fitzwilliam Street, Dublin
 J. Lambert Jones, Woodpark, Upper Rathmines, Dublin
 R. K. Knox, L.L.D., Northern Bank, 1 College Gardens, Belfast
 E. H. Knox, Greenwood Park, Crossmolina, Co. Mayo
 Judge Kelly, Tuam
 T. A. Kelly, 1 and 2 Westmoreland Street, Dublin
 The Duke of Leinster, Representatives of, 13 Lower Dominick Street,
 Dublin

The Hon. Mrs. Morgan Deane, Ardcanrisk, Co. Wexford
 Dr. H. B. Murray, 3 College Square East, Belfast
 Lord Macnaghten, 198 Queen's Gate, London, S.W.
 Lord Massereene and Fethard, Antrim Castle, Antrim
 W. G. Mitchell, Estate Office, Doneraile, Co. Cork
 F. W. D. Mitchell, 23 Rutland Square, Dublin
 F. W. Moore, Botanic Gardens, Glasnevin
 A. M'Crea, Castlecomer, Co. Kilkenny
 J. M'Kenzie, Forester's Lodge, Cullen, N.B.
 Florence M'Carthy, Skibbereen, Co. Cork
 David M'Beath, Crushmere Lodge, Drumcliffe, Co. Sligo
 Duncan McQuish, Crieff, N.B.
 Geo. Marshall, 6 Seymour Street, Portland Square, W.
 Wm. Mitchell, Forester, Gort, Co. Galway
 R. A. Mack, Fernbank, Victoria Road, Cork
 Owen M. Neary, Cookstown House, Ardee
 T. P. O'Nowlan, M.A., Mount Mellery
 The Right Hon. Lord Oxmantown, Birr Castle, King's Co.
 J. W. Oliver, Oughterard, Co. Galway
 T. W. O'Hanrahan, J.P., Tilbury, Co. Kilkenny
 Chas. O'Connor, K.C., 50 Upper Mount Street, Dublin
 J. L. Pigott, Somerby Road, Greystones
 Miss E. H. Porter, Belle Isle, Lisbellaw
 Walter Pigot, 6 Sydenham Road, Dundrum, Co. Dublin
 Jonathan Pim, 10 Herbert Street, Dublin
 Joseph Pim, Rin-na-mara, Monkstown, Co. Dublin
 J. Potter, Liffey Saw Mills, Dublin
 Mrs. Fitzmaurice Pratt, Glen Haste, Manor-Kilbride, Co. Dublin
 Geo. Perry, J.P., 20 Elgin Road, Dublin
 Johannes Rafu, Copenhagen
 Thomas Robertson, Estate Office, Woodlawn, Co. Galway
 Captain Shawe-Taylor, Castle Taylor, Ardahan, Co. Galway
 John C. Smith, Abbeyleix, Queen's Co.
 James Smyth, 1 Oxmantown Mall, Birr, King's Co.
 Peter Schott, Knittelsheim Palatine, Germany
 E. D. Till, The Priory, Eynsford, Kent
 Lindsey Talbot-Crosbie, Ardferf Abbey, Ardferf, Co. Kerry
 Walter S. Tighe, Coolmoney, Stratford-on-Slaney, Co. Wexford
 F. A. B. Turner, Clonattin, Gorey
 C. E. Vandeleur, Estate Office, Mallow
 R. H. Prior Wandesforde, Castlecomer House, Castlecomer
 A. B. B. Wilkinson, Drumboe, Bantry, Co. Cork
 A. H. Wynne, Collon, Co. Louth
 W. H. Wilson, Belvoir Park, Belfast, Co. Down

Mr. Wilson, Auchinleck, Scotland

Thomas W. Webber, Kellyville, Athy

George Wilson Lyons, Hazelhatch, Co. Kildare

J. Mackay Wilson, Currygrane, Edgeworthstown, Co. Longford

A. E. Wild, 3 Spring Terrace, Richmond, Surrey

George Watson, 10 Dame Street, Dublin

Miss Ada Yeates, 39 Ormond Road, Rathmines, Co. Dublin

CONTENTS.

	PAGE
CURRENT TOPICS AND SHORT NOTES :—	
Purchase of Scotch Experimental Area	307
Irish Forestry	307
Summer Meeting of Royal English Arboricultural Society .	307
Forestry Instruction at Oxford	308
New Appointments	310
International Forestry Congress at Vienna	312
Conference on Forestry in London	313
Forestry Exhibitions	314
Fungus attacking Lime Trees	315
Larch Insects	316
Timber Sale in North Lincolnshire	316
Manby Sale and Railway Rates	317
OBITUARY NOTICES :—	
Sir Dietrich Brandis	317
Mr. Philip Baylis	319
Mr. L. Boppe	320
ORIGINAL ARTICLES :—	
The Variations of <i>Salix alba</i> . By E. R. Pratt	320
Sutton Park. By A. P. Grenfell	338
REPRINTS :—	
The Cost of Forest Planting (Journal of the Irish Department of Agriculture)	342
Witches' Brooms. By W. B. Havelock	348
Creosoting of Home-grown Timber. By W. B. Havelock .	350

REVIEWS AND NOTICES OF BOOKS :—

"The Trees of Great Britain and Ireland." By Elwes and Henry	354
"Preservation of Timber from Rot." By E. Henry . . .	358
Mathey's "Commercial Utilisation of Timber"	360
Transactions of the Royal Scottish Arboricultural Society .	361
"The Indian Forester" for May, June and July	363
"The Longleaf Pine in Virgin Forest." By G. F. Schwarz .	365
Publications of the United States Department of Agriculture .	367
"Bulletin de la Société Forestière de Franche Comté et Belfort," June, 1907	368
"Bulletin of the Imperial Institute"	368
Huffel's "Economie Forestière." Vol. III.	369

OFFICIAL PAPERS :—

Report of the Afforestation Conference in London, June 25th, 1907	373
---	-----



TALL OAK AT WHITFIELD PARK, HEREFORDSHIRE.
From "The Trees of Great Britain and Ireland." (Vide p. 356)

Quarterly Journal of Forestry.

No. 4.]

OCTOBER, 1907.

[VOL. I.]

Current Topics and Short Notes.

Scotch Experimental Area.—The Crown has purchased the Inverliever estate on the western side of Loch Awe, in Argyllshire, 12,500 acres, worth about £2 per acre, and from 400 to 1,200 feet in altitude. It is hoped to make a start in planting next year. It is situated on archæan rock.

Irish Forestry.—Mr. T. W. Russell, M.P., Vice-President of Irish Agriculture and Technical Instruction has appointed a committee to settle the question referred to in our July number, namely, that of dealing with the mountain and waste land, as well as the woodlands, belonging to estates sold to tenant farmers, which we suggested might be retained by the State and handed over to the county councils for afforestation and management under the tutelage of the State department. The urgency of this project was brought to the notice of Lord Carnarvon, then Viceroy of Ireland, by Dr. Schlich, in 1885, when he was deputed to write a report on the Irish woodlands. The matter has since been dormant for twenty-two years, and it is a sign of the revival of interest in forestry, on the part of the Government, that this very urgent matter in which Sir H. Plunket was greatly interested has now been taken up by his successor.

The following are the members of the Committee:—Mr. T. P. Gill, Secretary of the Irish Department of Agriculture, etc. (Chairman), Right Hon. Lord Castletown, C.M.G., D.L., Mr. William Redmond, M.P., The Most Rev. Dennis Kelly, D.D. (Bishop of Ross), Member of the Agricultural Board Mr. Hugh de Fallenburg Montgomery, Member of the Agricultural Board, Mr. W. F. Bailey C.B. (Estates Commissioner), Mr. William Rogers Fisher, M.A., and Professor John R. Campbell, Assistant Secretary of Irish Agriculture.

Summer Meeting of the R.E.A.S.—The summer meeting of the Royal English Arboricultural Society had its headquarters at the Queen's Hotel, Cheltenham, from the 12th to the 16th August. Nearly one hundred members with a few of their friends attended the meeting. Interesting tours were made in Lord Bathurst's woods; the grounds of the Royal Agricultural College, Cirencester; Colesborne, the estate of H. J. Elwes, Esq., F.R.S., President of the Society; Lord Ducie's estate at Tortworth; the High Meadow wood belonging to the Crown, and Lady Smyth's woods at Ashton Court, near Bristol. A report of the business proceedings will be issued to Members of the Royal English Arboricultural Society only, but the descriptions of the woodlands visited are deferred till our next number. So are the prize essays. The Right Hon. E. Stafford Howard, C.B., invited several French forest officers, including M. Daubrée, Director-General of French Forests and honorary Vice-President of the Society, to stay with him at Thornbury Castle and attend the meeting. Only one of these, M. Leddet, the Conservator of Forests, at Paris, was able to accept this invitation. M. Leddet received a most hearty welcome from the members present and thoroughly enjoyed his visit. He was most struck with the plan adopted at Colesborne and Cirencester of planting larch and beech woods, and expressed his thorough appreciation of the excellence of this mixture.

Forestry Instruction at Oxford.—A party of twenty-seven forest students from Oxford visited some French forests, including the splendid silver-fir forests of the Vosges Mountains, where £2 per acre net is obtained, in the best forests, as for instance in that belonging to the little town of Celles. They were most hospitably entertained by the French forest students, at Nancy, where they inspected the fine natural history collections of the forest school, and they experienced the usual kind reception from the local French forest officers in the different forests they visited.

Messrs. Jolly, Robinson, Smythies and Glover, four students of the second year, obtained first-class degrees in honours in Physics and Geology, besides several others taking second and third class honours in Geology and Botany. The thirteen

students of the third year have now returned from Germany, where they have spent nine months in practical forest work, and will proceed to India, the Soudan, and the Malay States, in October. The seventeen students of the second year will then go to Germany. The following is a list of the twenty-two probationers selected in July, by the Government, for service in the Indian and Colonial forests:—

- Ainslee, J. R., Aberdeen University.
- Alington, G. H., Trinity College, Oxford.
- Collier, J. V., Christchurch, Oxford.
- Collins, H. C., Clifton College.
- David, A. N., Aldenham School, Herts.
- Goldberg, G. H. A., Private Tuition.
- Greswell, E. A., Hertford College, Oxford.
- Gwyer, C., Christchurch, Oxford.
- Hanbury, G. S., Christchurch, Oxford.
- Hiley, A. C., Monmouth Grammar School.
- Lee, M., Presentation College, Cork.
- Lewis, H. C., Exeter College, Oxford.
- Lyall, J. H., Exeter College, Oxford.
- Mason, L., Christchurch, Oxford.
- Meiklejohn, H., Edinburgh University.
- Meredith, H. R., Rugby School.
- Nixon, A. B., Trinity College, Oxford.
- Park, J. W. H., St. John's School, Leatherhead.
- Silvanus, D. H. M., Guy's Hospital.
- Simcox, G. N., Marlborough College.
- White, R. M., Trinity College, Oxford.
- Wright, L. F. L., Kelly College, Tavistock.

Oxford, situated in the very centre of England, is probably the best place in the United Kingdom for a central forest school for the Empire. Bagley Wood, close to the city, 600 acres, on the coral-rag and superposed quaternary strata, and with soils of every description, is a splendid area for nursery work and experimental plantations. The Tubney arboretum, on sand, is six miles from Oxford and surrounded by woods. The Chiltern Hills, on the chalk and superposed gravelly loams, with about 50,000 acres of beech selection woods and natural regeneration, are within easy distance by rail and road.

Woburn woods, 5,000 acres, on the Lower Greensand, contain some of the finest Scots pine woods in Britain, if not anywhere, with natural regeneration. The best pine timber there is of excellent quality and is sold standing at 10*s.* per cubic foot. Windsor Forest, 14,000 acres, with immense areas on the Bagshot sand, of Scots pine, larch, and chestnut, and 1,200 acres of oak, is within easy reach by rail. The excellent experimental plantations at Cooper's Hill, now seventeen years old, are visited by the students when they go to Windsor Forest. Lord Bathurst's woods, at Cirencester, of beech high forest, and coppice-with-standards (2,000 acres) with a rotation of twenty years, and splendid larch standards, on the Great Oolite, are within an hour-and-a-half's journey. The Forest of Dean, 24,000 acres, chiefly oak high forest, and the High Meadow wood, 3,285 acres, of coppice with fine oak and larch standards (both on Old Red Sandstone, with other strata) are to be regularly visited by the second year students. Alice Holt oak wood, 2,000 acres, on the Gault, is as near as Windsor Forest. The Oxshott coverts, 720 acres, on the London clay, excellent coppice with a rotation of fourteen years and with oak standards, is regularly visited. Several of these woodlands are already under working-plans.

There are also other woods that are occasionally visited. Nuneham Park, Blenheim, and Wychwood, near Oxford, Dropmore, with splendid larches and other trees; Bowood, belonging to the Marquess of Lansdowne. Dr. Watney's woods at Buckhurst, near Pangbourn, are also within easy distance. Such a wealth of varied forest growth rarely, if ever, exists in the neighbourhood of a forest school, while theoretical teaching of silviculture is almost useless without at least one day's work a week among trees, as is regularly practised at Oxford.

New Appointments.—The vacant post of Deputy Surveyor in the Forest of Dean, caused by the sudden and greatly lamented death of Mr. P. Baylis, has been filled by the appointment of Mr. V. F. Leese by the Prime Minister. Mr. Leese is a professional associate of the Surveyors' Institution, and was educated at Winchester, where he was captain of the

cricket eleven, and afterwards studied at Trinity College, Cambridge. He has had considerable experience in the following estates: Bickton, Devonshire, belonging to the late Hon. Mark Rolle; Marquess Campden's estate at Bayham Abbey; Mr. Watson Taylor's estate, Earlstoke Park; that of Mr. Locke King, Weybridge; he was recently agent to Sir G. Cooper, Bart., at Harsley, near Winchester. He is a very capable estate agent, and has made a special study of forestry.

Forestry education is now making such progress in Britain that we are in a position to demand that the appointments of deputy surveyor of the Crown forests, those of forestry adviser to the Commissioners of Woods and Forests, and to the Departments of Agriculture in England, Scotland, and Ireland, and eventually in Wales, as well as the professorships in forestry at our different forest schools, should be held only by men who have obtained diplomas of special excellence in forestry. Intelligent men will not be induced to undergo the long and expensive training that a competent forester must undergo, unless they know that there are certain remunerative and responsible posts to which they may eventually succeed. Professor Somerville, now at Oxford, was attached for several years to the Board of Agriculture, where his knowledge of forestry must be badly missed. Our Government requires to have under its control a strong body of forest experts, to whose advice it may have recourse on important occasions, instead of adopting the cumbrous plan of summoning irresponsible experts and amateur foresters from all parts of the country. Advice gratis may be cheap but is not always very valuable, and it cannot be always said that in the multitude of counsellors there is safety.

Mr. E. P. Popert, the Assistant Surveyor in the Forest of Dean, has been appointed Consulting Forester to the Commissioners of Woods, in addition to his present post. His work in Dean Forest will now be confined to the direction of forest operations and he will advise the Commissioners in the management of all the Crown woodlands, collect forest statistics, and prepare working-plans.

Mr. Augustine Henry, M.A., F.L.S., a native of Derry, in Ireland, who is well known to our readers as one of the editors

312 International Forestry Congress at Vienna.

of this Journal, has been appointed Reader in Forestry to the University of Cambridge, and we wish him every success in his new post. Mr. Henry studied with great credit for two years at the Nancy Forest School ; he has travelled much and has seen, besides most British woodlands, the forests of China, Japan, North America, France, Spain, Corsica, and Algeria. He is also a most experienced and accurate botanist, being associated with Mr. H. J. Elwes, F.R.S., in the authorship of "The Trees of Great Britain and Ireland."

Mr. D. E. Hutchins, F.R.Met.S., formerly in the Mysore Forest Service and, since 1882, Conservator of Forests in Cape Town and Director of the Forest School of South Africa, has been appointed by the Secretary of State for the Colonies, Conservator of Forests of the East African Protectorate and of Uganda. He has written a report on the very valuable forests of Mount Kenia, which will be fully noticed in our next number. Mr. Hutchins obtained a diploma from the Nancy Forest School in 1872. He is about fifty-six years old, but has the vigour and energy of a comparatively young man.

The vacant professorship of forestry and estate management at the Royal Agricultural College, Cirencester, has been filled by the appointment of Mr. H. A. Pritchard, F.S.I., and Watney Prizeman for Forestry, to succeed Dr. Maw.

The Secretary of State for the Colonies has appointed Mr. Crawford Noble (junior), as Assistant Forest Officer in Cyprus. He obtained the diploma of Agriculture at Aberdeen University and studied forestry for two years at Nancy.

International Forestry Congress at Vienna.—The International Forestry Congress is held every three years in conjunction with that of the International Congress of Agriculture. The last three meetings were at Paris in 1900, at Rome in 1903, and this year at Vienna. We have heard on good authority that this meeting of forest delegates from nearly all civilised countries was very successful, and that the reception accorded to the delegates by the Emperor, who personally received them, and by the City of Vienna was most magnificent

and cordial. The forests of Gratzen in Bohemia, chiefly of spruce, with silver-fir, beech, oak, and other species, were visited, as well as other forests. An account of the proceedings of the Congress will be given in our December number.

It is very regrettable that the United Kingdom was not represented. Mr. E. Stafford Howard, C.B., Professor Schlich, F.R.S., C.I.E., Mr. W. R. Fisher and other English foresters were present at the Paris Congress, but no official British forest delegates attended the Congresses at Rome and Vienna. Mr. H. J. Elwes, F.R.S., and the Editor of this Journal, were deputed by the Royal English Arboricultural Society to attend the Vienna Congress; Mr. Fisher's duties at Oxford prevented his doing so, and Mr. Elwes was unfortunately unable to be present, owing to a serious family trouble. We have not heard that the Royal Scottish Arboricultural Society deputed anyone to attend the Congress, and our Home Government has no real forestry department that could depute anyone, so that the British Empire was unrepresented at a meeting where all the other States of Europe and America and Japan sent delegates. India certainly should have been represented.

There is every prospect that the International Agricultural Congress, of which the Forestry Congress is a component part, will be held in London some day, and it is highly important that arrangements should be made for our country to be represented at the next Congress in 1910, so that we may be sufficiently organised to receive the foreign forestry delegates when they come to London. Foreign delegates get their expenses, in part at any rate, paid by their respective Governments, and this fact should be remembered at the Treasury when the next Congress is held.

Conference on Forestry in London.—A conference, called by the Board of Agriculture and the Local Government Board, met in a committee room of the House of Lords, on the 25th June. An account of the proceedings taken partly from the official report and partly from private sources is given on p. 373.

Forestry Exhibitions.—The Forestry Exhibition at the Royal Agricultural Show at Lincoln was fully up to the excellence of former years. Great credit is due to Mr. G. Marshall, one of the past presidents of the Royal English Arboricultural Society, for the energy and skill with which he organises these exhibitions. An account is given further on of some of the exhibits.

The Bath and West and South Counties Society's Show at Swindon, held 31st May to 5th June, also included a Forestry Exhibition, and an account of this, written by Mr. A. Henry, M.A., F.L.S., is given in the Society's Journal.

The value of creosoting wood so as to increase its durability was shown by Lady Smyth, of Ashton Court, near Bristol, by an excellent plan of a creosote tank, with practical directions for use, accompanied by wood-specimens. The Marquis of Bath also showed creosote posts and fencing-stakes, put down in 1893, and still sound.

Earl Fortescue showed some boards of larch and Douglas fir planted in 1875 side by side in good loam on a south-east aspect. The Douglas fir had grown to 40 cubic feet, and the larch to 21 cubic feet, in forty years. Lord Carnarvon showed fine clean planks of Corsican pine, free from knots, sixty-one years old. Brown oak appears to be unknown on the Continent, and has not been noticed in Ireland. Its dependence on particular kinds of soil is tolerably well established. In this respect it is analogous to the dark chestnut wood grown in Corsica, when such wood is useless for making extract of tannin. Southwell, an English chemist, at Bastia, in Corsica, states that dark chestnut wood is due to iron in the soil that is taken up by the wood, and neutralises the tannin. Mr. Richardson, of Stamford, showed a photograph of a brown oak tree sold for £100, grown on the lias clay in Northamptonshire, where there is much iron ore in the oolite above the clay.

Mr. Henry states that Douglas fir, redwood, and *Thuya plicata* (*gigantea*), from the Pacific Coast of America, show continuous good growth in Britain, while no Japanese tree does so. Hence it is doubtful if any Japanese tree, except *Cryptomeria japonica*, can be safely recommended here for profitable planting. He further suggests that at forestry exhibitions prizes should

be awarded rather for the merits of the report thereon than for the quality of the timber exhibited, and he suggests the following nature of report: Plank, or log; estate; species; soil; aspect; altitude; situation—open park, waterside, hedgerow. If grown in close plantation; origin, if possible, of seed; original number of plants; present number per acre; age; average height and girth at chest height; produce of thinnings in volume and value; final crop; general remarks.

Fungus attacking Lime Trees.—Mr. J. Gilbert of Treval, near Torpoint, Cornwall, reports that a few years ago General Sir Reginald Pole-Carew planted a fine avenue of Taurian limes (*Tilia dasystyla*) near the mansion, at Antony, and in the autumn of 1905, finding that the trees (which had been planted before he took over the management) were not doing well, it was found on examination that the roots were practically in a pool of water.

The land was drained, the trees lifted by hydraulic jacks, put in a good layer of loam about three feet under them, and the whole avenue raised something like 3 or 4 feet.

Last winter the avenue was extended by planting some new trees. A week or two ago two of the largest of those that were first planted were looking wrong. The glossy dark green of the leaves—which is such a noticeable feature—has disappeared, and the leaves were turning rather yellow.

A series of blisters appeared on the bark, some 5 or 6 feet from the ground. At first a white resinous exudation appeared, which turned black as it ran down the bark of the tree, and then at the point where the exudation appeared, a blister, something like larch-blister in shape, which seemed to be gradually increasing in size.

This disease in a lime is strange, nothing quite like it occurs in Schlich's "Manual of Forestry." The nearest approach to it is the beech-blister referred to in Vol. IV. (*Nectria ditissima*).

Mr. Gilbert is anxious to know what the trouble is, how it is caused, and whether there is a remedy, as the idea of losing this fine avenue of limes is very alarming.

Larch insects.—Mr. John Roberts, Crown woodman at Chepstow, Tintern Woods, reports that the larch-miner (*Argyresthia laevigatella*) has attacked vigorous larches in that locality, both leaves and side-shoots being affected. This moth appears to be widespread. It also attacks the larch in Lord Bathurst's woods at Cirencester. Further information regarding the extent of the injury thus caused to larch and the localities where it occurs will be very acceptable.

Mr. J. Smith Hill paid a visit to Keswick lately and found that the ravages of the larch-sawfly, *Nematus Erichsoni*, now extend over a length of at least ten miles. Two plantations are completely defoliated, the trees are brown and look as if dead. This pest is evidently extending. Handpicking of the larvæ has been resorted to, and the Board of Agriculture has issued a circular on the subject, which can be obtained gratis on application.

Timber-Sale in North Lincolnshire.—The annual auction sale of felled timber on the Manby Estate of the Earl of Yarborough was held on Wednesday, July 31st, at the tree-root, and was attended by over fifty buyers. All kinds of timber met with a ready sale, and at higher prices than last year.

The following is a summary of the prices realised, and it must be borne in mind that 1 inch in 12 in the quarter girth was allowed on all unpeeled timber :

10,006 feet of peeled oak, straight, round and well-hearted, averaging 11½ cubic feet per tree, made 1s. 1¾d. per foot.

1,584 feet beech, averaging 75 feet, made 11½d. per foot, highest price 1s. 2½d. per foot.

255 feet ash, averaging 28 feet, made 1s. 10½d. per foot, highest price 2s. 5½d. per foot.

366 feet sycamore, averaging 16 feet, made 1s. 4d. per foot; best tree, containing 75 feet, made 2s. 1½d. per foot.

Elm made up to 11d., spruce 4d., and beech tops 5½d. per foot respectively.

The timber was all drawn into lots, averaging about 80 cubic feet each, and the nearest stations are three and four miles distant.

W. B. HAVELOCK.

Manby Timber Sale and Railway Rates.—A contributor writes: "I regret to find the railway charges are so heavy from Brigg to Leicester, being 18s. 6d. per ton. The rate from Grimsby to Leicester is only 10s. per ton for foreign timber; this is a serious anomaly, and tells very much against the English timber-trade."

Obituary Notices.

SIR DIETRICH BRANDIS, K.C.I.E., F.R.S.

Notice of the death of Sir D. Brandis was given in the July number of this journal, and most of our readers already know what great service this very intelligent and hardworking man has done for British forestry, both at home and in India. The Americans have recognised his services to their foresters who have for the last few years visited German forests, for which service President Roosevelt presented his portrait to Brandis; and the American foresters quite recently sent Lady Brandis a splendid silver service. Brandis' bust in bronze is in the Imperial Forest College at Dehra Dun, in India, which he founded, and the memory of his indefatigable energy and sympathy with his colleagues is in the hearts of all who have ever had the privilege to work with him.

Brandis was called in 1856, by Lord Dalhousie, to be superintendent of forests in Pegu, and saved the rich teak forests of Burmah from the irresponsible timber merchant, who has ruined such vast extents of forest in America and other countries. He became the first Inspector-General of Forests to the Government of India in 1864, a post he retained for nineteen years. During that time he visited all the important forests of India, and his rare botanical knowledge rendered his reports on those forests extremely interesting reading to every lover of nature, besides showing the financial and administrative acumen which he possessed. When inspecting these forests, he traversed them from early morning till sunset, while the evenings were spent in writing or dictating notes for his reports, that were written on steamboats, in railway

stations, anywhere that the occasion afforded between his lengthy tours, which usually lasted for the whole of the dry Indian season, from November to July, the rainy season being devoted to hard office work at Simla. It is thus that he built up the splendid forest service of India.

In 1867, he induced Lord Salisbury, then Secretary of State for India, to have men specially trained for the Indian forest service, having previously, in 1866, sent out Dr. Schlich and Mr. Ribbentrop, both of whom succeeded him as Inspectors-General of Forests in India. Since 1869, a steady stream of men, trained either in Germany or at the French Nancy Forest School, the former only for a few years, have joined the Indian service. From 1885 to 1905 they were trained at Cooper's Hill, and subsequently at Oxford. There are now in India 245 appointments for foresters trained in Europe, while men who have already worked there hold some of our most important colonial and home forest appointments.

In 1878, Brandis founded the Dehra Dun Forest School, which, since 1881, has trained numbers of useful men for the public service, some of whom are also employed in our colonies, while others have risen to high posts in the Indian forest service.

Since his retirement from India, Brandis became one of the visitors of the Cooper's Hill College, and directed for several years the continental training of the forest students. He made and described in 1878 the magnificent collection of Indian timbers that was the foundation of Gamble's book of Indian timbers, but to which that author has since added largely, and he devoted the last seven years of his strenuous life to his great work on Indian forest trees, shrubs, and climbers, that was reviewed in our April number.

His services were recognised by the Indian Government by his being made K.C.I.E., and by the scientific world by his being admitted as a Fellow of the Royal Society, and his death, at the advanced age of 83, terminates the career of one of the most useful and devoted servants of the State.

MR. PHILIP BAYLIS, LATE H.M. DEPUTY SURVEYOR OF
DEAN FOREST.

Mr. Philip Baylis was born at Ledbury, in 1848, was a member of St. John's College, Cambridge, and obtained honours in law, followed by the M.A. degree. He was admitted as a barrister-at-law of the Inner Temple, and practised on the Oxford circuit. He then became a revising barrister, and in 1893 was appointed by Lord Rosebery as Deputy Surveyor of the Forest of Dean, in succession to Sir James Campbell. His chief services in the Dean forest are twofold, and of very great value. In the first place, when he took over charge, the forest was overrun with sheep, no local beast-of-common, and it is owing to the energetic stand that he made against promiscuous and illegal sheep-grazing that there is now a possibility of securing natural reproduction of oak. This was not without danger to himself, for the sheep-owners blew up his sawmill with dynamite, set fire to the forest in several places, and cut down saplings, besides threatening him personally. But the general feeling of the people was on his side, for fenced forest pays rates, and unfenced forest does not, and this appeal to the pockets of the ratepayers proved most effective.

Mr. Baylis' second great work was the construction of good metalled roads in the forest, a public work that had been too long neglected, and on which many thousands of pounds were expended, during his tenure of office, by the Department of Woods and Forests. The forest nurseries were absolutely empty when he arrived, and they have now been largely extended, and are full of fine plants. It would be interesting to know how many millions of plants during his time have been planted in the Dean, the High Meadow Wood, and in the new estate lately purchased by the Crown from the Duke of Beaufort, where 200 men are now employed.

The whole system of management has been transformed, the appearance of the forest improved, and its revenues enhanced. The lodges occupied by the woodmen are now in perfect repair and the conditions under which the men work greatly improved.

A school for woodmen, under Mr. Hanson, has been established, while the assistant surveyor, Mr. Popert, looks after the purely technical part of the forest work ; working-plans for the

Dean Forest and High Meadow Wood have been made by the late Mr. H. C. Hill, then Inspector-General of Forests in India, and for the Tintern Woods by Mr. Popert.

Mr. Baylis twice took the best of the Crown woodmen to see representative French forests, and in every way promoted their interests, and improved their position. He was a keen archæologist, and knew the history of every stone in Tintern Abbey. His work as a justice of the peace, as alderman of the Gloucestershire County Council, and as a member of the County Education Board was acknowledged publicly after his lamented and sudden death at the early age of 58. He has left £10,000, after the death of his sisters, to St. John's College, Cambridge, to form mathematical scholarships..

MR. L. BOPPE, HONORARY DIRECTOR OF THE NANCY
FOREST SCHOOL.

Mr. Lucian Boppe, C.I.E., was for many years sub-director of the Nancy Forest School, and succeeded Mr. Puton as director. He was brought into close connection with the British foresters who were being trained there, and for his services in this respect was made a Companion of the Indian Empire, in 1885. During that year he made a tour in the British woodlands. His works on forest utilisation and silviculture are wellknown, the latter, in which Mr. Jolyet collaborated, being still the standard French work on that subject. On his retirement, he was made Honorary Director of the Nancy Forest School, and obtained many honourable marks of distinction from his own and foreign countries. His former pupils in India and all who knew him greatly regret his loss.

Original Articles.

THE VARIATIONS OF *SALIX ALBA*.

"Nullius enim tutior est reditus, minorisve impendii,
Aut tempestatum securior."—*Pliny*.

JOHN EVELYN in his "*Sylva*" (1664) fully endorses Pliny's opinion as to the economic value and hardy nature of the *Salices*, and as the views of foresters are now tending in the same direction, and some doubt exists as to the relative

value of the timber varieties of willow, I venture to attempt some further illumination of the subject.

These difficulties exist partly because foresters have not followed botanists in their classification of varieties, and partly because traders and manufacturers purchasing in the winter, without leaf or fruit to guide them, have chosen names indicated by habit, bark, or grain of timber after felling the trees.

The greater difficulty is of course the peculiar tendency of the *Salices* to vary in leaf, fruit, and habit, due to soil, climate, and situation. Very many trees lean partly to one variety and partly to another, making it quite impossible to allot them to a fixed type. These are called hybrids, and perhaps correctly so ; but it must be remembered that since practically no willow trees are grown from seed, cross-fertilisation, if it takes place, can have no effect on the trees of the present date. Any variation can now proceed only from cross-fertilisation of centuries ago, and from the varying conditions above-mentioned.

It may be contended that a certain number of trees in the country are from seedlings, and that these may or may not be cross-fertilised, but I cannot believe that this is the case, and I have only found one such instance, at Hargham in Norfolk. In this case of three 6-year-old poles, in a fir wood, the evidence was much in favour of their being seedlings, but not conclusive. If there had been many such trees we should find occasionally a small seedling from 6 inches to 6 feet high in such position as to substantiate this conjecture.

If it is considered how very small the seed is, it is obvious that only in the most extraordinarily favourable circumstances could such a seed produce a plant. This seed closely resembles the ordinary thistle-down, and it is notorious that not more than one seed of the thistle in millions produces a plant. The seed either cannot reach the ground, or is smothered by quicker growing vegetation. John Evelyn's "*Sylva*" supports this view (p. 257). It appears that he tried to sow osier beds, as on the Loire, in France, on his Wotton estate, "but the obstinate and unmerciful weeds did so confound them, that it was impossible to keep them clean with any ordinary industry, and so they were given over."

The shape of the ripe seed very much resembles that of the walnut, and its length is about $1\frac{1}{2}$ millimetres, and width 1 millimetre. It is rather less than about half the size of a pin's head. No doubt these seeds can be propagated under glass, and this I believe has been successfully done by Mr. L. Fosbrooke, of Ravenstone Hall, Ashby-de-la-Zouch. If any special type were selected as specially desirable it might be well to try and propagate its seeds, but it is uniformly accepted that the most secure way is by the planting of cuttings or rods and it is probable that cross-fertilisation is only occasionally attempted by botanists for experimental purposes.

The main points that we should endeavour to ascertain are what is really the most serviceable description of timber, especially with regard to its toughness and lightness (for the manufacture of cricket-bats, for which it is at present chiefly used). The smoothness of grain of willow-wood and its general adaptability for carpenters' work must also be considered, since it is quite as serviceable as larch, and its rapid growth makes it a more valuable tree for what may be called ordinary purposes.

It might be thought easy to ascertain the quality of the timber before the tree has been cut down, but this is not necessarily the case, because the buyer cannot know until he has cut up and sometimes seasoned his timber for twelve months whether it will weigh out light, or whether it is tough enough to stand pressure, and if he has ascertained this, he apparently is not able to note and remember the characteristics of flower and leaf, and confines himself, as a rule, to the appearance of the bark, not a very adequate test. The only thing that the bark tells him is that the *Salix fragilis* is less suitable for all work than the *Salix alba*. As, however, the buyer is out chiefly in the winter season he has little more than the bark to judge by. Mr. W. E. Bussey, of Peckham, in his booklet, "The Evolution of the Cricket-Bat," defines only by the bark, adding that his researches the wide world over confirm his opinion that the best quality of willow is to be found only in East Anglia.

The second point is the desirability of defining with some accuracy the sub-varieties of the *Salix alba* and this is

extremely difficult, since the immense amount of information to be gleaned is vague, incorrect and conflicting.

No notice will be taken of winter-buds, scales, or stipules, as these vary too irregularly to enable any conclusion to be formed. It is therefore possible to put before the reader only the characteristics of the trees that can be to some extent defined, with such photographs and micro-photographs as can be taken, in order that he may form some kind of conclusion.

In describing the varieties it is easier on the whole to follow Loudon in his "Arboretum et Fruticetum," but we must remember that he there says that differentiation is a matter of "great difficulty, the species being in a state of inextricable confusion."

I shall therefore deal with *Salix fragilis* (Linn.), Loudon, p. 1516; *Salix alba* (Linn.), Loudon, p. 1522; and *Salix cærulea* (Linn.), Loudon, p. 1523, adding *Salix viridis* as defined by the Rev. E. F. Linton, of Edmondsham, Salisbury.

This latter variety is not mentioned by Loudon. It must be here noted that in the *Salix fragilis* (Linn.) (ordine E. F. Linton), the *cærulea* does not occur, while the *viridis* is added, and this leads us to the question as to whether there is any marked difference between these two varieties.

It would be possible to quote the writings of botanist and forester, one after the other, as to the characteristics of each variety, but such quotations would be so frequently contradictory either in whole or in part, that I believe it would be an almost endless and quite useless proceeding to do so.

This will be best shown by saying that doubts have been expressed as to whether the five standard trees by the north side of the lake at Kew are examples of pure *Salix alba* or partly hybridisations with *Salix Babylonica*, and in an important botanical garden I have recently seen a lead label describing an undoubted *viridis*, as *Salix fragilis* ("good for cricket-bats"), whereas if one thing is wellknown it is that *fragilis* is not suitable for the purpose.

HABIT OF GROWTH.

Salix alba (Linn.).

Loudon speaks of the rapid growth of this species, even on inferior soils, and states that it has been more extensively planted as a timber tree than any other species.

This tree as aforesaid has been represented for some years by five specimens on the north bank of the lake at Kew Gardens, and must have been the source of much perplexity to inquirers, as it has been to myself. The habit is almost as upright as that of the other *Salices*, as far as the thicker branches are concerned, and the tops of them are distinctly pendulous, though not to the same extent as in the *Salix Babylonica* at the Botanical Gardens at Cambridge.

This will be seen in the photograph No. 01, which was taken by me on April 18th and shows this peculiarity, that the *alba* is in leaf much earlier than the adjoining *cærulea*; in fact, it might be said it was this year (1907) a fortnight earlier, bringing it thus closer to the Cambridge *Babylonica*, which also comes into leaf at an early date.

It may be here mentioned that *Salix viridis* and *S. cærulea* come into leaf simultaneously.

Of a large number of cuttings from these trees kindly given me some time ago by the authority at Kew Gardens, it is easier to speak from observation. These, compared with the other *alba* varieties, show great weakness of habit; the growth is fairly rapid, but they have no tendency to produce strong leaders, but are, on the contrary, apt to prefer drooping side branches and must be supported by sticks.

These trees cannot be recommended for commercial purposes, since the labour of sticking and pruning, &c., would make their culture quite unprofitable, even if the timber were of good quality.

There is only one conclusion to be drawn from the above, to the effect that these trees at Kew are not the true *Salix alba*, L., pure, as hitherto labelled and defined, but they lean very much to the *Salix Babylonica*, and I venture to agree with Mr. W. J. Bean, who is in charge of the Salicetum, at Kew, and has recently defined them as *Salix Salamoni*



No. 01.—*Salix alba* (Kew) (Query, *Babylonica* var. *Salomonii*), on North side of lake, and *Salix alba caerulea*. Showing the *alba* in leaf 14 days before the *caerulea*.



No. 02. — *Salix alba viridis* (female), upright variety. Soil, peat and sand.



No. 03. *Salix alba viridis* (male), drooping variety.



No. 04. *Salix alba viridis* (barren), broom-headed variety. Soil sand, peat, and soft clay.

(i.e., *S. alba* \times *Babylonica*). But for the purpose of this article I shall still call them *alba*, since they are so labelled.

Salix alba (cærulea).

The habit of this tree is certainly more robust than the *alba* of Kew in its earliest age, and is as, or nearly as, free-growing as the *viridis*. It is shown on the right of the photograph No. 01. It has not such an upright habit as is desirable, and all buyers of timber will inevitably prefer a tree of an upright habit. At present I know of no definitely acknowledged *cærulea* of any size, other than that in the photograph. This tree cannot be said to do this species full justice since it has apparently never been touched by the pruning-knife and has more the appearance of a shrub than of a tree.

Salix alba (viridis).

This tree is not mentioned by Loudon except very shortly on p. 1517, and then described as a synonym for *Salix Russelliana*, which is now considered synonymous with *Salix fragilis*.

It is, however, described in "Ordine Linton" as *alba* slightly hybridised with *Salix fragilis*, and this I think must be held to be the accepted definition.

It seems I think clear that the *Salix viridis* is the variety referred to by Loudon (vol. iii., p. 1524) thus:—

"In the parish of Waterbeach, Cambridgeshire, there are numerous trees of *Salix alba*, the vigorous shoots and branches of which, and especially those of pollard trees, have red bark, which when the trees are leafless in winter is very conspicuous. This appears to be the upland or red-twigged willow of Pontey, but it may possibly be only a *variation* of the species, or the female."

William Pontey was nurseryman and ornamental gardener to successive Dukes of Bedford and author of the "Forest Pruner" (1805) and the "Profitable Planter" (1809).

This variety approaches very closely to the *alba* of Loudon and other botanists, as hereafter shown; the growth is slightly more luxuriant, the branches upright.

While not desiring to dispute the opinion that this variety, due to the longer pedicel, is the result of long ago hybridisation with the *fragilis*, I prefer to look upon it as only a modification or variation from the *alba*.

The *fragilis* is a coarser tree, and its habit is to branch out horizontally, a habit not followed at any rate by the female *viridis*, neither are the younger leaves more glabrous or broader, like those of the *fragilis*, although so stated by Sir J. E. Smith, who however, by saying that the leaves have a "more azure hue" implies that they have not the characteristic of the *fragilis* in this respect.

Salix fragilis.

This tree is the coarsest and rankest growing of the timber willows, and rather resembles the poplar (which is also of the order of the *Salicaceæ*) in width of leaf, and quality and want of grain in the timber; it is rightly named from the brittleness of its branches, and the quality of its timber is admitted to be distinctly inferior to that of the other varieties.

The habit of the species is to throw out horizontal branches, and in no degree does it approach the upright habit of the *alba*, *viridis* and *cærulea*; it is almost the only representative of the tree-willow in Scotland and the west of England, while in the eastern counties the *alba* varieties predominate.

The habit of these four varieties must vary considerably. They become dwarfed and die if planted on chalk or gravel or pure peat. They flourish best in silt and soft clay, and are naturally improved by a greater preponderance of humus, or in other words on a richer soil. They also depend enormously upon an unlimited amount of running water.

Amongst trees, however, growing in precisely the same soil, and having the same leaf and bark, variation is found. It may be that the inferiority of the soil in which the tree is growing, from that on which the original sett was cut, accounts for this, or that underneath apparently the same soil, there may be



No. 1.—*Salix caerulea*. (Borrer's Collection, 1821.)



No. 2.—*Salix caerulea*. (From Audley End, Essex, May 11, 1842.) Leece.



No. 1a. — Ditto. $\times 20$.



No. 2.—Ditto.



No. 3.—*Salix alba*, Obwa. Th.
Teplouchow. (May 30, 1898.)



No. 4.—*Salix alba*, Kew. (May 21,
1907.)



No. 3a. Ditto. $\times 20$.



No. 4a. Ditto. $\times 20$.

some small portions of soil or stagnant water to make the difference, but I cannot think this is the reason.

Loudon (p. 1455), writing as to the variation caused by sex says: "Botanists seem to differ in opinion as to the influence which the sex has upon the character or appearance of the plants." Dr. Walker says that:—

"The male and female of the same species often differ remarkably from each other in their foliage,"

and he instances the *Salix alba* (Linn.), in the female of which he says:—

"The leaves are much larger, greener and not so white, silvery, and pubescent as those of the male. This makes the difference in their aspect so great, that when standing together they might at first view be presumed to be different species."

In general, *he adds*:—

"The female of most plants is of more vigorous growth, of larger size, and less brittle than the male; and therefore the female ought always to be preferred, when the species is to be cultivated for economical purposes that require strength, and the male, for those that require delicacy."

Sir J. E. Smith, who states that he laboured full thirty years with diffidence and mistrust in the study of willows in Mr. Crow's garden at Lakenheath, near Norwich, holds an opinion very different from that of Dr. Walker, asserting that

"There is not the slightest possible difference in the character or appearance of the two individuals in any other respect than in their flowers."

As before stated, no doubt soil, climate and situation enormously affect the appearance of these trees, but do not account sufficiently for their variation.

I am convinced that Dr. Walker was and is correct in his views, except as to pubescence, and I believe that it will be shortly endorsed by all those who observe their trees more closely.

The photograph No. 02 shows *Salix alba* (*viridis*). This being a female tree has a robust, upright habit, the branches being at a very acute angle to the trunk, although the tree has always been in the open ground and not closed in or drawn up by other trees. In No. 03 is shown a male tree or "drooper," and

the branches here show a much more horizontal habit of growth, and might almost be called "flatheaded."

There is a third variety, No. 04, in which no catkins appear, and the habit of this tree is still more stunted, its top being "broomheaded," rather than lancet-shaped, as is the female *alba*.

Loudon adds that most botanists agree with Dr. Walker, and mention the splendid engravings of Dr. Host, of Vienna (1827), as evidence to that effect.

He adds—that the importance of knowing to what sex any species of willow belongs is obvious.

The male variety exists in very much less degree in East Anglia than the female. In Smith's "English Botany," the male is stated not to have been discovered, but Borrer asserts that it exists near Chichester, almost to the exclusion of the female.

Timber-buyers object to the drooping variety, recognising the fact that the timber is heavier, but as a matter of fact in purchasing, it does not appear that they always carry out their theory by offering a lower price. Their main desire is apparently to secure clean and straight trees, which are obviously the best.

Some trees having the same characteristics, become what may be termed "broom-headed," apparently without any reason as to soil, since they are found amongst the upright growing trees. These trees are slow-growing, with a determined attempt to throw out side-shoots, and are barren, showing no signs of sex, and with smaller leaves, indicating of course an inferior power of growth. There are also sometimes specimens of the same tree amongst the quickly growing trees, so dwarfed, as to be apparently of a different species. These apparently are the trees that are most liable to be attacked by the cynips, which deposit their eggs in the summit of the twigs, and thus induce the rose-like formation of leaves, that caused our old English botanists to call this variety the Helix or rose willow (Loudon, p. 1491), and name it as a distinct species. It may, however, be noticed that the more roseate the leaves, the worse the growth, the insects choosing the least thrifty trees, and injuring them still further in their growth.



No. 5.—*Salix viridis*, 4 years sett.
(Ryston, May 18, 1907.)



No. 6.—*Salix viridis*, 80 years old tree.
(Ryston, May 18, 1907.)



No. 5a.—Ditto. $\times 20$.



No. 6a. - Ditto. $\times 20$.



No. 7.—*Salix alba*, var. *carulea*, Kew.
(May 21, 1907.)



No. 8.—*Salix viridis*. (July 16, 1907.)



No. 7a. Ditto. $\times 20$.



No. 8a. Ditto. $\times 20$.

VARIATIONS OF FRUIT.

Salix alba, L., var. *cærulea*.

Nothing is said by Loudon (p. 1523) or by other botanists as to any variation in fruit, and I think it must be accepted that the ovaries are like those of the *alba*, sessile, or nearly so.

In No. 1, from Borrer's collection made in 1821, this is not as clear as desirable, but it is better shown in No. 2, collected by Leefe, at Audley End, in Essex, on May 11th, 1842. The tree is described by him as of exceptional size and quality, and of very rapid growth.

In No. 7, from the tree in the previous photograph, No. 01, kindly sent me by Mr. Bean, May 21, the ovaries are distinctly sessile; though in No. 7a, the stripping of the scale rather impairs this view. The pubescence of the leaves is also shown.

Salix fragilis.

The ovaries of the above are described by Loudon as ovate, abrupt, nearly sessile, glabrous. The pedicels are sometimes of considerable size, exceeding two millimetres in length, and this is considered the main distinction between it and the *alba* of Loudon.

The catkins are also larger, longer and narrower than in the other varieties, the ovaries are much the same, perhaps a little longer, but it is difficult to assert this, since the shape so much depends upon the date on which they are examined.

I do not give an illustration of catkins, since there is no necessity to do so, but they would much resemble No. 3, in which the pedicels are long. This is described as *Salix alba* (May 30th, 1898), from Obwa, in Russia, by M. Thomas Teplouchow, but it must be an instance of variation, either in the plant, or in the judgment of the author.

Salix alba.

The distinguishing feature on which botanists rely is that these ovaries are sessile. This is the case in No. 4, which was picked from one of the five trees at Kew on May 21st, but the

scales are shown to be glabrous, and not glaucous. An observer seeing that the ovaries are sessile, might be apt to judge too rashly that they were *albas*, not noticing the habit, leaves, or scales.

Salix alba (viridis).

The catkins of the above are not described by Loudon, but Mr. Linton, whose authority I am accepting throughout these remarks, describes the ovaries of the *viridis* as similar to the pure *alba*, with the exception that the pedicel is slightly longer, and thus approaches the longer one of the *fragilis*.

There appears to be no difference in their scales, which are glaucous in all cases.

In Figs. 5 and 6 are illustrations of the above at Ryston, picked May 8th, and are believed to be examples of the East Anglian timber willow or red-twigged willow of Pontey.

No. 5 is from a sett of four years growth, No. 6 from a very large tree about eighty years old. These ovaries are so nearly sessile that it is difficult to show that any *viridis* strain exists, but the pedicels vary in every tree, though never exceeding half the length of the *fragilis* pedicel. It will be noted that in the upper figures the ovaries seem much more sessile than in the lower ones. This is caused by the removal of the scales, leaving a space which gives the appearance of a longer pedicel.

VARIATIONS OF BARK.

I have not thought well to give any opinions I have heard from timber-merchants as to the fruit, leaf, or general appearance of willow trees. Their only preference in this respect lies with those trees which have lancet rather than round heads, and have upright branches, which obviously denotes thrifty growing trees. Their only comparison lies in the bark, and therefore since the varieties of the *Salix alba* do not differ in this respect they compare their bark with that of *Salix fragilis* only. This characteristic is most clearly marked, and is distinctly shown in the two photographs annexed.

As is well known, the *fragilis* is termed by them the open-bark willow, and the *alba*, the close-bark willow; and as in



PLATE A.

Bark of *Salix fragilis* or open-bark willow, 20 years old, grown at Ryston, Norfolk (Ketts oak wood), 10 yards from No. 31. Soil moist sandy loam. Photograph taken 2½ feet from tree, 3 feet from ground, N.W. side.



PLATE B.

Bark of *Salix viridis* or close-bark willow, 20 years old, grown at Ryston (Ketts oak wood), Norfolk. 10 yards from No. 32. Soil moist sandy loam. Photograph taken $2\frac{1}{2}$ feet from tree, 3 feet from ground, N.W. side.

the illustration (Plate A) it is clear that the outer bark, or rhytidom, is ruptured into large prominences by the new tissues formed by the phelloderm or cork-cambium.

The width of the cork, according to the scale on the tree, is about $1\frac{1}{4}$ inches. The ruptures, however, in the close-bark (Plate B) are much smaller, and might be considered as about the width of half-an-inch.

The photographs, however, are sufficiently clear to show the great difference in the two kinds of trees, and no further comment is necessary.

TIMBER.

Sir J. Smith (Loudon, p. 1523) asserts that the *cœrulea* is of greater value for timber than other forms of *alba*, and of quicker growth, but thinks it the same as the red-twiggèd willow of Pontey.

When we magnify the surfaces fifty times, we can see nothing sufficient to suggest any very distinct difference in the quality of the timber.

In these illustrations the left-hand microphotograph is the longitudinal tangential section, on the right, the longitudinal radial section, and below is the transverse section.

The illustrations 10 and 11 are from trees at Roos Hall, in Suffolk, which were chosen because they were all on apparently exactly similar soil growing side-by-side in very large numbers.

The strength of wood is supposed to depend on the distribution of fibres and their length, and also on the hardening and thickening of their walls. No appreciable difference in these respects can be detected.

The upright variety—nearly always the female—seems to have rather larger vessels and cortical fibres, and if these two photographs are representative as to the class of trees, it may be considered that the larger cells will produce a lighter and therefore more valuable wood, at any rate for the purpose for which they are used, the production of cricket-bats.

In plates Nos. 12 and 13, the wood for which are both kindly sent by Mr. Warsop, of Little Badow, in Essex, there is not much difference, and yet he states that whereas No. 12 is

of the best possible quality, No. 13 is very heavy and useless. It may possibly be urged that the cells in No. 12 are the larger. Unfortunately, the senders of these specimens were not aware of the sex of the trees from which they came.

The upper portions of the transverse sections of these two trees show the slower deposit of the annual ring during the autumn, the larger cells below being deposited in the spring. It is argued that the larger cells of a quick-growing tree produce lighter timber.

In No. 14 (*S. fragilis*, or open bark) the cells are larger than in the other sections, but do not seem to be so frequently bisected. They are considerably further apart, and this fact cancels the effect of their size in giving lightness to the wood. The wood is not as tough as in the *alba*s, and gives way more readily under pressure.

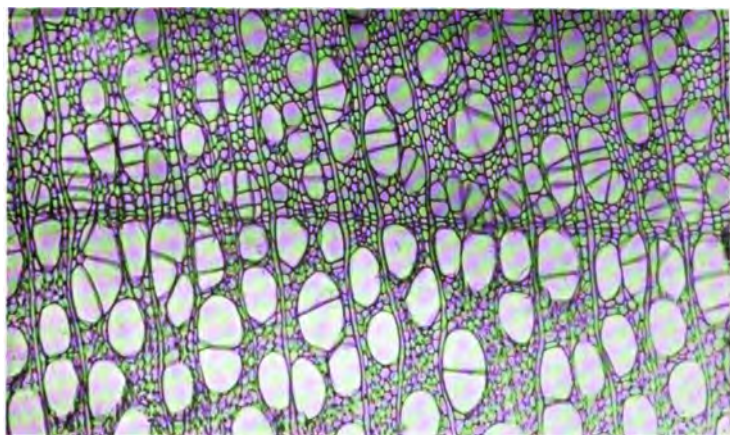
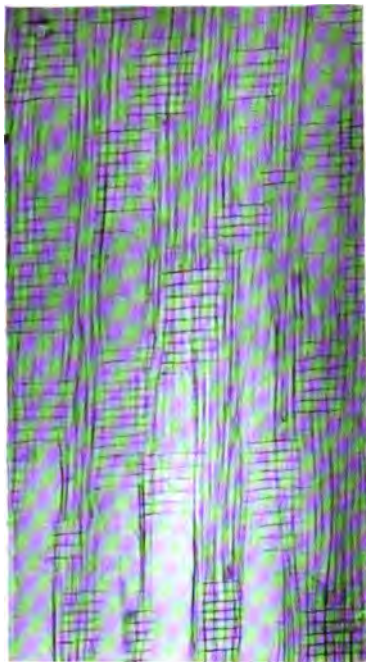
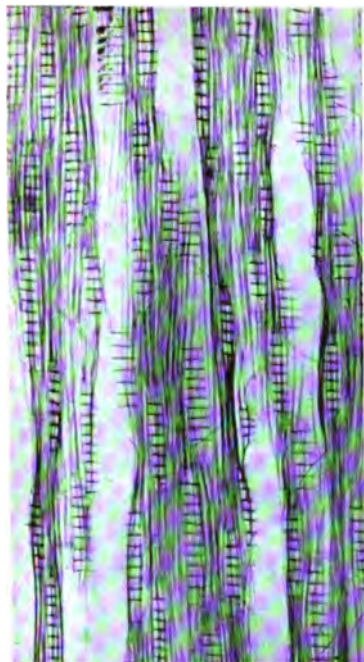
VARIATION OF LEAVES.

The leaves of the *Salix alba*, L., are described by Loudon, p. 1523, as "elliptic, lanceolate, serrated with glanded serratures, hairy especially when young, with adpressed silky hairs, giving the foliage a light or whitish hue." Brown, Scaling, Selby, Nicholson, and others, unite in describing them as elliptic, lanceolate, acute, serrate, both sides covered with adpressed silky hairs, producing silver-tinted foliage, looking like a huge feather spangled with silver.

This is the common attribute of the three closely related varieties. Loudon describes the *cærulea* as "taper-pointed, serrated, the underside almost naked of hairs;" but Mr. Linton does not admit this, but says they are only less silky. He describes the *alba* as producing "a bright grey leaf covered with white persistent hairs, *cærulea* having a less grey colour, the leaves a more bluish green, and the hairs more deciduous."

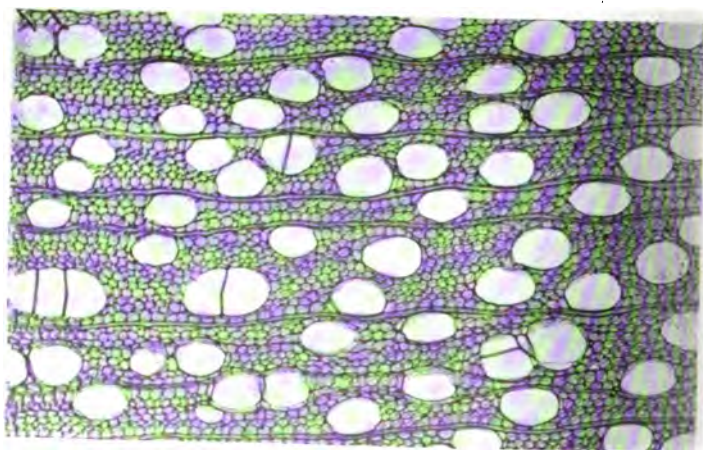
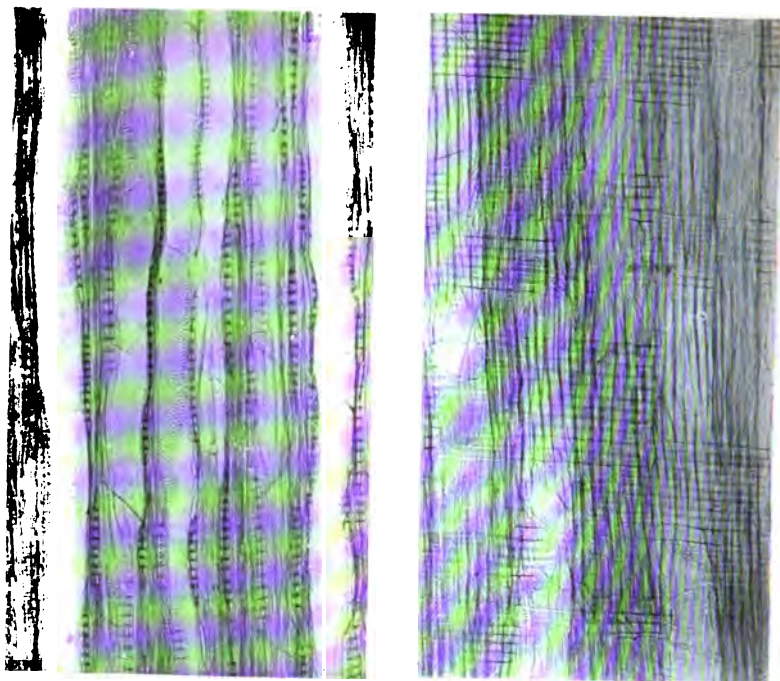
The leaves of the *Salix viridis* are not supposed to differ from the pure *alba*.

The photographs Nos. 15 to 18 are of the first unfolded leaf, and full-grown leaf, magnified 100 times (also picked June 17th, tree 20 years). No. 15, *Salix viridis* (female), the silky hairs

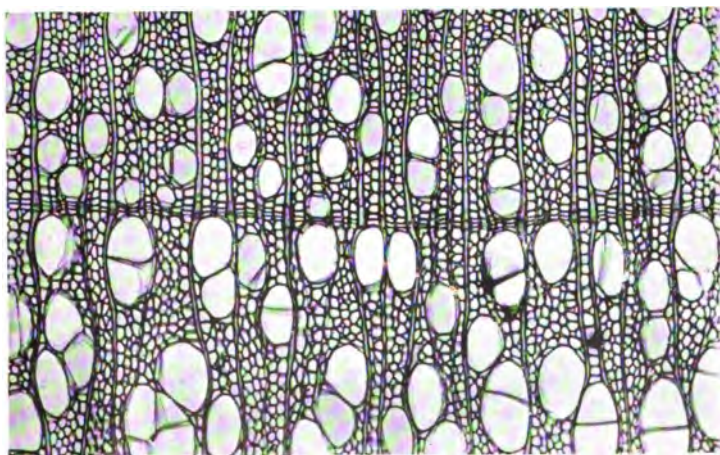
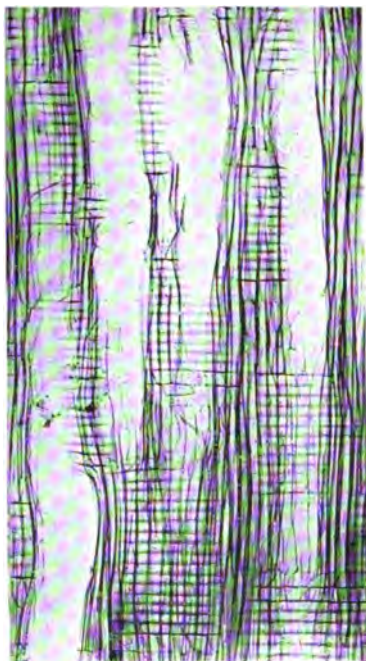
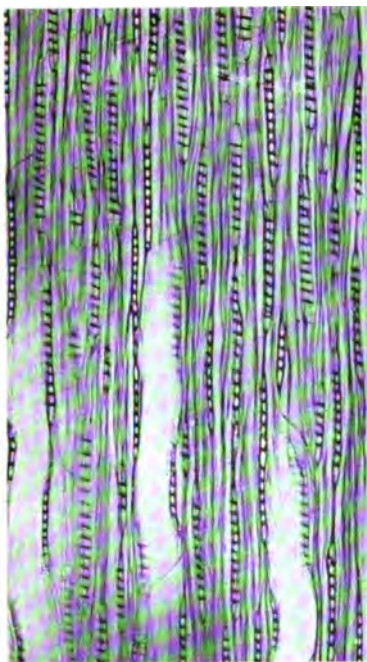


No. 1c.—*Salix viridis*, drooping variety from Mr. F. W. D. Robinson, Roos Hall, Beccles, Suffolk.

Tree under 20 years old, growing in marshlands near river Waveney. Soil peat, silt and sand. These trees have the appearance of *viridis* (Linton) (and Loudon), the branches are, however, slightly more horizontal and weaker, so as to cause the drooping appearance. Sapwood, 2 inches from heartwood, 5 feet from ground, 4 inches from bark. Magnified 50 diameters.

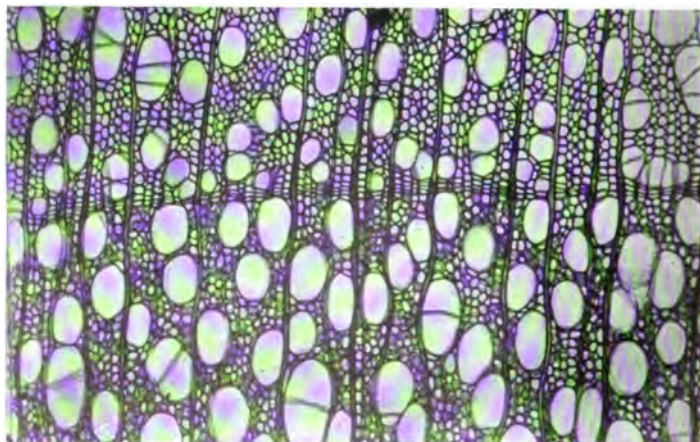
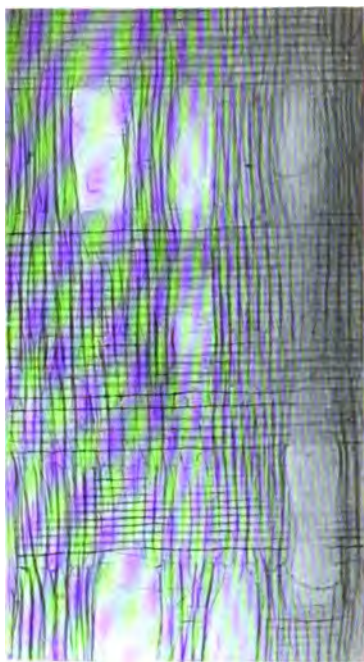
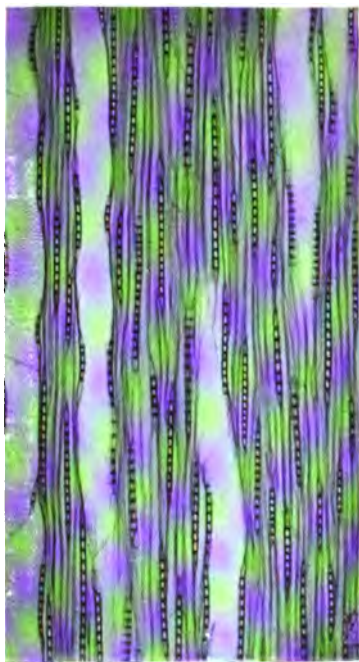


No. 11.—*Salix viridis*, upright variety from Mr. F. W. D. Robinson, Roos Hall, Beccles, Suffolk.
 Tree under 20 years old growing in marshlands, near river Waveney. Soil peat, silt and sand. These trees have the appearance of *viridis*, as described by Loudon and others, as *Salix alba*, but now found to be the variety *viridis* by Mr. Linton, 1905. Sapwood, 2 inches from heartwood, 5 feet from ground, 4 inches from bark. Magnified 50 diameters.



No. 12.—Close-bark willow. Best possible quality. Felled April, 1906.
Mr. Walter Warsop, Little Baddow, Essex.

Tree within 3 miles. Age of tree 33 years. Best mixed clay loam: sample taken 3 feet from ground. Sapwood 2 inches from heartwood and 4 inches from bark. Magnified 50 diameters.

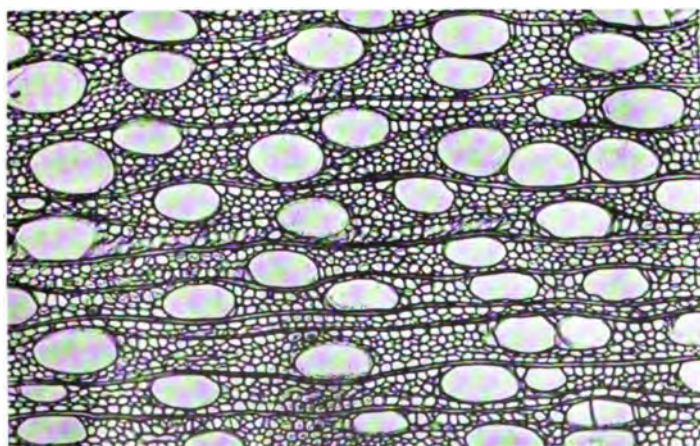
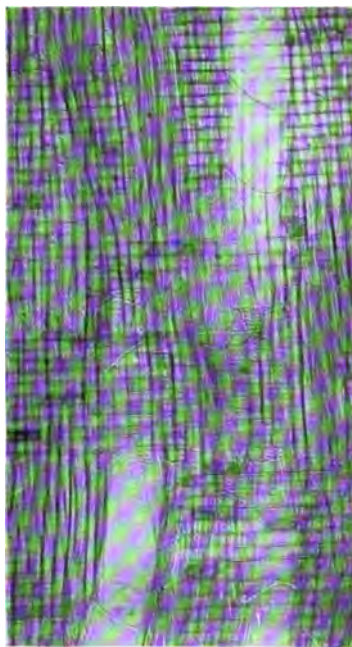
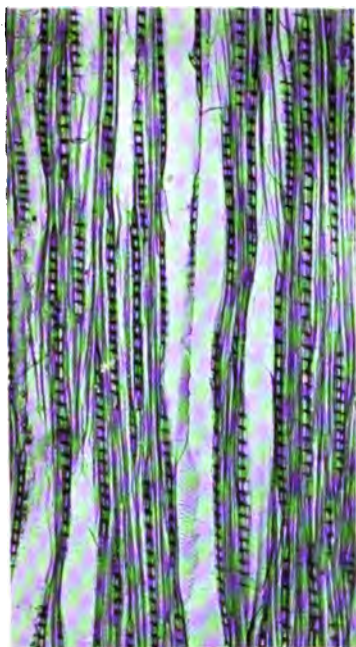


No. 13.--Inferior close-bark bat willow.

Mr. Walter Warsop, Little Baddow, Essex.

Tree grown in Berkshire. 19 years old. Soil silt on clay; sample taken 6 feet from ground, and is sapwood 2 inches from edge of heartwood.

Mr. Warsop adds, " This sample is taken from the best close-bark tree I have seen in Berkshire. I had it with some very fair open bark trees; how this sort got there no one seems to know, certainly there is no other for miles. It is very heavy, but has been felled 2 months only.



No. 14.—Best open-bark bat willow (*Salix fragilis*) grown in Berkshire, close to No. 13.

Mr. Walter Warsop, Little Baddow, Essex.

Soil silt upon clay; sample taken 3 feet from ground, 2 inches from heart-wood, and 2 inches from bark of tree.

“This wood will make a bat nearly as good as any and superior to many.”



No. 15.—(Portions of the third, or first open leaf of the branch, and adult leaf.)
S. alba, var. *viridis* (female), June 17th. $\times 100$.



No. 16.—(Vitto) *S. alba*, var. *viridis* (male), June 17th. $\times 100$.



No. 17.—(Ditto) *S. alba*, var. *viridis* (barren), June 17th. $\times 100$.



No. 18. (Ditto) *S. alba*, var. *carulea*. June 17th. $\times 100$.

are most apparent, and in this respect there is no trace of the hybridisation with the *fragilis*, nor do the leaves show the lighter colour which its influence should produce. Its leaves are I believe a little larger than those of the *alba*, and in this way only they approach the *fragilis*.

No. 16, *Salix viridis* (male), picked from a tree in similar soil, on same date and tree of same age, shows the smaller leaf, less pubescent; and this is, I think, typical of the sex.

No. 17, *Salix viridis* or *alba*, from same soil, place, and picked on the same date. This is from a dwarfed tree about six years old, but produces no flower at all. The leaves are of the same colour, but distinctly smaller, and subject to the attacks of the cynips before mentioned. It will be noticed that the adult leaf is glabrous, although the younger one is as silky as those of the other varieties.

It might be thought that these leaves being so different in size, would imply a totally different variety; but this is not so, since in some four year old trees we have found on the same tree the large pubescent leaf of the female *alba viridis*.

The leaves of all the *albas* are pubescent when young; when adult, less so. As soon as the leaf has arrived at full maturity, the long hairs begin to disappear, and all the leaves become glabrous before falling off in the autumn, so that this smoothness in the barren variety comes from want of full maturity, the leaves never attaining their full size, but become prematurely aged and the loss of hairs follow as a matter of course.

No. 18, *Salix cærulea*, picked same date. This is from a three years sett of the Kew *cærulea*; the leaves are lanceolate and not broader than the others, as supposed, but as Mr. Linton says, they appear slightly less silky. I can see no difference in the colour, but as this sett is planted in a different soil, the comparison is not of very much value.

Mr. Fosbrooke thinks that the *alba* and *cærulea* are equally silky at an early period of their growth, "but that the latter loses the minute hairs when the foliage is matured, especially on the underside of the leaf." He adds:—"The difference is quite observable in the late summer, and if the two varieties are planted side by side, and the foliage viewed as a mass, *S. cærulea* is distinctly darker in tone and bluer in colour."

The differences shown in these photographs are not very marked, and it would not be wise to attempt any deductions from a single leaf, however carefully selected, as typical. The leaves were taken from the south sides of trees, and it may be that the pubescence is more marked there, as it may also be where the soil is richer.

There is, however, a desire to find an accepted difference between the *cærulea* and the *alba* of Loudon, and, as previously shown, this can be found only in the amount of pubescence of the early and adult leaves.

We may therefore accept the above authorities, which are supported by No. 15. And in addition we may assert that the greater the pubescence the greater the vitality of the variety; but this apparently leaves no difference between the *cærulea* and the male *alba*.

Observers must not be confused by leaves from shoots from the lower parts of the *albas*, especially where they have been pruned; these leaves are of a much brighter green, larger, and resemble the leaves of the *fragilis* in every respect, except that a slight pubescence is found on the smaller leaves, practically non-existing in the *fragilis*. This is I suppose partly due to a more sheltered or shady position and the excessive flow of sap, since the same occurs in the shoots from stools.

COLOUR OF YOUNG WOOD OR TWIGS IN WINTER.

As a rule the winter-twigs of the *Salix alba* (*viridis*) are a deep red, and owing to this fact and to the red colour of the heart wood, the tree has been frequently known as a red willow, thus causing considerable confusion. Loudon, in speaking of the red-twigged willow of Pontey (vol. 3, p. 1524), says that the "red twigs are found only on the female plant, the young wood of the male being of a whitish green."

Dr. Host of Vienna said "the colour of the young wood in the one sex often differs from that of the other; for example, the young shoots of the *alba* female are not only stronger and the leaves broader than those of the male, but the bark is of a dark red, while the young wood of the male is of a whitish green."

Mr. Linton thought, April 3rd, 1903, that the variation of the twigs of the *viridis* varied between the greenness of twigs of the one parent and the redness of the other, adding "that the *Salix fragilis* usually reddens more or less as it matures."

It must be admitted that as the female plant commonly predominates in East Anglia, as do the red-twiggèd trees, the evidence of this being due to sex, as Loudon suggests, is very strong. This redness is greatest in the early spring, but as the twig is gradually superseded by the next year's shoot it becomes coarser and loses its bright red colour. On the whole I am inclined to think that the deeper the red colour of the winter shoot, the nearer approach to the *viridis*, to the red-twiggèd willow of Pontey, and to the strongest type of our timber willows.

It may be said that the balance of evidence seems to prove :—

(1) That the young wood of the female *alba* and *viridis* is generally red in the winter, the *viridis* always so.

(2) That the male plant is generally brownish-green twiggèd.

(3) That the *fragilis* of both sexes is green-twiggèd and never a very dark red.

VARIATION IN WEIGHT OF TIMBER.

As before said, the greatest object in endeavouring to diagnose these different variations is to ascertain which of these varieties and which sex and soil produces the best timber for general use. Generally speaking the heavier the timber the more lasting and therefore better, but at the present time since this wood is of far greater value for the manufacture of bats than for any other purpose, we must take into consideration that at the present time cricketers greatly prefer the lightest wood, and are prepared to pay a comparatively fancy price for it.

It would be unwise to dogmatise since the evidence on these points is not conclusive, but the figures below tend to show that as a rule the female *viridis*, growing faster and with a less tendency to produce knots, is the lighter in specific gravity.

The baulks of wood named below were all cut from sapling trees of the same age, the lowest length being always taken, and the relative amount of sapwood and heartwood equal.

NO. I. TABLE, SHOWING LOSS OF WEIGHT OF TREES OF BOTH SEXES AFTER BEING SEASONED IN A TEMPERATURE OF 65° FAHR.

	Weight when felled.		Weight four weeks later.		Loss of Weight of each Baulk.		Weight sixteen days later.		Additional loss of weight.	
Engine Belt Fordham, Norfolk.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Silt and peat soil :										
A. <i>Salix alba viridis</i> (male)...	62	'08	44	'08	18	0	42	1	2	7
B. " " " (female)...	47	'04	34	10	12	10	33	'01	1	9
Jubilee Wood, Roxham, Norfolk.										
Silt and peat soil :										
C. <i>S. alba viridis</i> (male) ...	58	4	44	0	14	4	41	5	2	11
D. " " " (female) ...	57	13	44	1	13	12	40	0	4	1
Snowre Hall, Belt Fordham, Norfolk.										
Silt and clay soil :										
E. <i>S. alba viridis</i> (male) ...	53	8	43	2	10	6	41	0	2	2
F. " " " (female) ...	45	0	36	15	8	1	35	0	1	15
Centre Plantation, Bexwell, Norfolk.										
Soil, silt and clay :										
G. <i>S. alba viridis</i> (male) ...	51	4	42	4	9	0	39	10	2	10
H. " " " (female) ...	42	4	36	1	6	3	32	11	3	6

NO. II. TABLE, SHOWING THE RELATIVE SPECIFIC GRAVITY OF MALE AND FEMALE TREES, AND THEIR RELATIVE LOSS OF WEIGHT AFTER SIX WEEKS' SEASONING.

Male Trees.	Weight when felled.		After six weeks.		Female Trees.	Weight when felled.		After six weeks.	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.	lbs.	ozs.
A	62	8	42	1	B	47	4	33	1
C	58	4	41	5	D	57	13	40	0
E	53	8	41	0	F	45	0	35	0
G	51	4	39	10	H	42	4	32	11
Totals	225	8	164	0	Totals	192	5	140	12

The weight of the male trees thus exceeds that of the female trees by :

When felled—

33 lbs. 3 ozs., or 14½ per cent.

After seasoning—

24 lbs. 3 ozs., or 14½ per cent.

It is shown by the above table that the total weight of the baulks of the male trees when felled was 225 lbs. 8 ozs.; that of the female trees, 192 lbs. 5 ozs.; the greater weight of males being 33 lbs. 3 ozs., or $14\frac{1}{4}$ per cent.

After the short seasoning the weight of males was 164 lbs., that of females 140 lbs. 12 ozs.; the greater weight of the male being 24 lbs. 3 ozs., or $14\frac{1}{4}$ per cent.

NO. III. TABLE, SHOWING THE SPECIFIC GRAVITY OF TREES GROWN IN PEAT AND SILT, COMPARED WITH THOSE GROWN IN CLAY AND SILT.

Peat and Silt grown trees.	Weight when felled.		Weight after six weeks.		Clay and Silt grown trees.	Weight when felled.		Weight after six weeks.	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.	lbs.	ozs.
A	62	8	42	1	E	53	8	41	0
B	47	4	33	1	F	45	0	35	0
C	58	4	41	5	G	51	4	39	10
D	57	13	40	0	H	42	4	32	11
Totals	225	13	156	7	Totals	192	0	148	5

The weight of the peat and silt grown trees thus exceeds that of the clay and silt grown trees by:

When felled—
33 lbs. 13 ozs., or $14\frac{1}{4}$ per cent.

After seasoning—
8 lbs. 2 ozs., or $5\frac{1}{2}$ per cent.

These peat and silt grown trees, having practically unlimited moisture, greatly exceed the others in weight when felled, but this rapidly seasons out, and it is probable that after another month they will have the same specific gravity.

After this date the peat grown timber would be considerably lighter, and thus of greater value should the fibres have the same tenacity.

EDWARD ROGER PRATT.

ROYSTON HALL,
DOWNHAM, NORFOLK.
July 30th, 1907.

SUTTON PARK.

THIS large tract of land, belonging to the town of Sutton Coldfield, comprises an area of over 5,000 acres. It is situated on glacial drift at an elevation of over 500 feet, and is interesting as forming part of the old Forest of Arden. Though most of the park is open heather and gorse land, yet there are considerable areas of old natural forest of more than ordinary interest to the professional forester, since they show what fine trees have been produced in the past in what at first sight appears to be an unpromising soil and situation.

It is true that most of these old woods have fallen into decay, the large oaks, which are their chief feature, being usually stagheaded and not in a thriving condition, while few promising saplings are coming forward to take their place.

An examination of the present conditions and modes of treatment will allow it to be determined if the objects of management can be adequately fulfilled, and if not to outline the methods that are most likely to ensure this being effected.

This will not be an easy task, for not only are the ordinary difficulties of restoring fine woods on a poor soil and exposed situation to be dealt with, but the question is complicated by the smokiness of the atmosphere, which, although not so detrimental as in the Black Country proper, is certainly sufficient to handicap sensitive species like the spruce and the silver-fir, which might be useful as soil-improvers.

Apart from the remains of the natural woods, certain areas of open land have been enclosed, beginning about forty or fifty years ago and planted with conifers, the youngest plantation being some fifteen years old, while the more open spaces in the natural woods have also been planted up with them.

The original woods consisted, in recent times, almost entirely of oak, chiefly sessile, with an undergrowth of hollies. That the oak can grow to fine dimensions is sufficiently proved by the few large specimens that remain, though these are all stagheaded. The younger generation unfortunately are mostly in the same plight, and it is very doubtful if they will live to

attain the same size. Clumps of middle-aged oaks at the north of the park and in Streatley Wood, however, seem thriving. It is probable, therefore, that the oak requires to be grown not as isolated trees emerging from a sea of holly, but in clumps of high forest, with the trees fairly close together in order to prevent the undue development of side branches, which, combined with the rather smoky atmosphere, evidently conduces to stagheadedness. A great deal of pruning and thinning of young plantations of hardwoods with larch and Scotch nurses is being carried out. Most of this work seemed quite unnecessary whatever the object in view, and on the other hand most of the young and middle aged oaks would have benefited greatly from careful pruning. The amount of holly seems to have increased of recent years, until in some of the woods it occupies the ground almost exclusively, especially in Hollyhurst. About twenty years ago there was a heavy fall of oaks, which apparently encouraged the holly. As a result, in most places the holly is so thick that oak seedlings cannot spring up, so that unless this species can be favoured in some way it must ultimately die out. Had there continued to be a thicker stand of oak, the holly would make a very fair lower "storey" to improve and protect the soil, and yet would not have been so thick as to prevent a natural growth of seedlings; or there would have been some vacant patches which might have been planted with good chance of success, as we see in a fine clump of oak on the north-east. The soil is a glacial drift throughout the park, very shallow in most places; the subsoil is gravel; though poor, the roots can easily penetrate to a good depth on the rises, which are naturally well drained, and though the growth appears slow, yet trees can live to become of large size.

The elevation varies between 400 and nearly 600 feet, though the greater part of the area lies between 450 and 500 feet. This is a considerable altitude for this part of the country, with the result that the flatter and more exposed portions are rather windswept.

It is therefore of importance, as regards good growth of trees, that they should be close enough to protect one another and to keep the soil free from grass and weeds. With the exception

of those parts where the holly has taken almost complete possession of the soil, this is not the case.

The conclusion forced upon one is that in Sutton Park one cannot (as is often the case in England) afford to dispense with the requirements of good forestry, *i.e.*, the main crop in the oaks must be grown thickly enough to draw them up to a fair height. The second storey, or undergrowth, should be thick enough to keep the soil in good condition, and yet not so thick that it allows no chance of the nobler species propagating their kind. Unless a complete clearance is made, holly does not always, and apparently cannot until there is a larger stand of thriving oaks, fulfil the desired conditions, consequently efforts should be made to introduce such species as the beech, hornbeam, and Norway maple, which can form part of the lower or upper storey as may be required. Silver-fir and spruce are probably not suitable, owing to the smokiness of the atmosphere, as the few spruce already planted do not seem to thrive, though this may be due to their not being grown in close canopy.

RECENT PLANTATIONS, THEIR CONDITION AND TREATMENT : SUGGESTIONS FOR IMPROVEMENT AND FUTURE PLANTING.

In Gomslade wood, consisting chiefly of an excess of holly and stagheaded oak, a small new plantation was noticed, a quarter of an acre in extent, set out at about 6 by 5 with larch, Douglas fir, beech, birch, and oak.

This was in a sheltered spot, and nurses probably were unnecessary—it would have been better to have planted beech and oak, 4 ft. by 4 ft., either pure or, if nurses were required, with a proportion up to half of Scotch pine or larch, to be removed as more space was demanded by the oak and beech. The Douglas fir looked unhealthy ; it probably requires a purer air and better soil than is generally met with in the park. The existing nurseryman's mixture is unlikely to produce a clump of fine trees.

Elsewhere, near Keepers pool, a young plantation of hardwoods—oak, beech, ash, etc., with Scotch and larch nurses—was being thinned and pruned.

The object being presumably to produce fine oaks and other

hardwoods, the only work necessary would have been to remove such of the conifers as were suppressing the hardwoods, instead of which the trees were being thinned out to too small a stand per acre, the conifers being left and their side branches pruned. The only result can be deterioration of the soil and a poor crop of a mixture of half a dozen species, which it will be very difficult to treat on sound silvicultural lines. That this is so, is evidenced by the state of older woods also composed of a mixture of hardwoods and conifers, which have either been planted too widely, or thinned too heavily. The conifer nurses, if meant as such, are suppressing the hardwoods, while the canopy is insufficient to maintain the soil in such a condition as to allow the oak to come to the finest development of which it is capable in the park.

A young plantation, fifteen years old, of Scotch pine and beech, with few spruce and larch closely planted, is doing well, complete canopy having been formed. To grow oak, ash and maple so as to produce fine trees, the method suggested is on the more sheltered spots to plant these closely with a large admixture of beech and hornbeam, and on the poorer soils, or in more exposed places, with Scotch pine nurses. Where the oak in the plantations with nurses thrives, the conifers should be thinned out so as to leave a wood entirely composed of hardwoods; where it does not, the oak may allowed to be suppressed and a crop of beech and Scotch pine will be the result.

As the woods are mainly for recreation and ornament, a few ornamental species, such as birch, whitebeam, mountain ash, etc., may be introduced in small clumps, in place of the oak, but the mistake should not be made of planting one area with a haphazard mixture of half a dozen species and more. The whitebeam was planted about a generation ago with the happiest results, and is now more than maintaining itself.

SUMMARY.

The objects of management being to maintain these woods as recreation grounds, and in the case of the older woods not to depart too widely from their original character, which,

until fairly recent times, must have been that of oak woods with an undergrowth of holly, it will be desirable, in places where the ground is so covered with holly as to make it impassable, to make clearances to be planted with oak and beech. Where the stand is so thin that oaks and other hardwoods are getting branchy and stagheaded, they should be underplanted with beech or hornbeam. Where the canopy is close, it should be maintained, so as to discourage the growth of weeds, and thinning done cautiously, with a full knowledge of the end in view. At present too much ground is given up to impenetrable thickets of holly and weeds. There is no danger that under any system of improved management the woods will become too trim and orderly, but much can be done to bring order out of confusion and restore the former "natural" appearance of the woods instead of the existing artificial one. If any extension of the wooded area is to be made, suitable conifers may be properly introduced and maintained in new plantations, but they seem out of place in old historic woods.

28th March, 1907.

A. P. GRENFELL.

Reprints.

THE COST OF FOREST PLANTING.*

SINCE sylviculture, or the cultivation of trees for timber production, began to be practised in European countries attention has always been closely directed to the various items of expenditure which are incurred from time to time before the mature timber can be delivered into the hands of the consumer. One of the most important of these items is the expenditure connected with the sowing or planting of the ground that has been cleared of an old crop, or in cases where

* Reprinted from the *Journal of the Irish Department of Agriculture*, July, 1907.

no timber previously existed, with growing a plantation or forest on bare ground.

The Need of Systematic Planting.—Forests grown under perfectly natural conditions, and properly protected against man, domestic animals, fire, &c., invariably reproduce themselves from seed without artificial assistance; but the crop of trees so produced is usually patchy and irregular, and although sufficiently dense to retain the forest character of the surface it covers, seldom satisfies the requirements of the owner in the quantity and quality of the timber it produces. With certain species, and under favourable climatic conditions, careful methods of thinning and felling an old crop of timber often result in a plentiful crop of seed being shed under conditions which favour its germination and development into a thick crop of seedlings. By such methods forests of beech and oak in the lowlands, and of silver-fir on mountain ranges, are regenerated in France and Southern Germany as they mature, and the working expenses of these forests are considerably reduced thereby. But to trust entirely to this method of regeneration certain natural advantages in the way of soil, situation, and climate, and the existence of large areas of properly managed forests of certain species, are necessary, otherwise the results are so imperfect and uncertain that the saving effected on the cost of artificial methods of regeneration is negatived by the low returns in timber and money. The more intense the cultivation of the forest, the less inclined the forester becomes to trust to natural methods, which often involve loss of time and a certain irregularity in the crops, gradually leading up to a poorly and improperly stocked area of woodland. While older systems of forestry, therefore, trusted largely to natural regeneration for the perpetuation of forest crops, modern forestry attempts to make the most of the comparatively small area at its disposal by artificial sowing or planting at definite intervals.

The Advantages of Sowing and Planting Considered.—The necessity for artificial methods of growing or replacing plantations being admitted, the question next to be considered is the comparative advantages of sowing or planting. From an abstract point of view, everything points to the superiority of sowing,

as this is supported by experience gained in the kindred industries of agriculture and horticulture. But when the character of the ground over which the forester has to work, the cost of the seed from which his plants are produced, and the slow rate of growth of the latter during the first two or three years are collectively taken into account, the difficulties attending the successful raising of forest crops from seed are self-evident. Ground on which large plantations are formed has invariably an uneven and rocky surface, and it is often partially covered by low scrub or rank weeds or grasses which prevent cultivation by steam or horses. To prepare anything approaching a proper seed-bed in lines or patches for the smaller tree seeds, hand labour is necessary, and would entail an expenditure of at least £2 to £3 per acre at the outset, and a considerable outlay during the next two or three years. The prices of many kinds of tree seeds are comparatively high, and to sow thickly enough to allow for seed and seedlings destroyed by birds, mice and other enemies, would add at least £1 to the cost, while in a large number of cases the thickest sowings would not suffice to produce a full crop. With large seeds and strong seedlings, such as oak, Spanish chestnut, beech, &c., sowing may sometimes prove successful, but with coniferous and small seeds generally, the failures resulting from sowing in open ground are too numerous to invest the method with any popularity, unless the conditions are exceptionally favourable. In the North German plain, for instance, which is covered principally by thick deposits of diluvial sand, Scotch pine is sown quite as frequently as planted, but the sandy soil is well prepared by grubbing out the roots of the old crop, a practice which would be out of the question on stony or hard ground; and in any case requires cheap labour, and a demand for firewood or charcoal, for which the extracted stumps are alone suitable.

Planting gives the better Result.—Cost of Planting varies with Conditions.—Some Estimates.—If the above assumptions are correct—and experience confirms them on all sides—it is quite clear that planting is the only method of growing plantations that can be expected to give satisfactory results in all cases. The only possible objection to it is the fact that its cost comes

at the very outset of a plantation's life, and at a time when it is especially desirable to reduce all expenditure to a minimum. Any outlay at this stage means the sinking of capital for periods varying, with different species, from 50 to 100 years, upon which compound interest must be allowed until the capital is paid back from the proceeds of the crop. The lower the rate of interest charged, the longer, of course, the capital takes to accumulate to any given sum, but at $2\frac{1}{2}$ per cent. interest a sum of £5 will amount in round numbers to £30 in seventy-five years, every additional pound at the beginning adding nearly £6 to the amount at the end of the period. As £5 may be considered the lowest average figure at which planting can be done per acre, and $2\frac{1}{2}$ per cent. the lowest rate of interest at which a landowner is willing to invest money on his property, it follows that no net return can be obtained for timber production until, at the very least, £30 per acre has been deducted from the sum realised from the sale of timber requiring seventy-five years to mature. In addition to this deduction further allowances must be made for annual expenses, management, &c., but these are often partially covered by shooting rents, the value of thinnings, &c., and are of a more variable character. The main point to be considered here, however, is the extent to which the costs of planting may be reduced under varying conditions of soil, situation, and species planted. Estimates of the cost of planting often vary from £2 or £3, to £8 or £10, per acre, and to the uninitiated it is often difficult to understand the reason for such a wide difference. In the first place, however, it is necessary to define the term "planting." By some it is used to express the various operations which have to be carried out in converting an open and bare hillside into an enclosed crop of healthy trees from five to six years of age. By others the term simply expresses the cost of plants and the manual labour employed in planting them, leaving out of account all items of expenditure connected with fencing, draining, cleaning the ground, and in most cases filling up blanks caused by deaths amongst the original crop. To understand this clearly, the cost of the various items may be summarised for the planting of two areas of rough land from 500 to 1,000 acres in extent, the one covered more or less with woody scrub,

or stunted tree growth, gorse, broom, etc., and the other with heather or thin grasses only. The cost of planting two such areas per acre will be as follows:—

	I.	II.
	s.	s.
Fencing	10	10
Cleaning	40	5
Plants (3,000)	50	40
Planting	30	20
Beating up	10	10
	<hr/>	<hr/>
	140	85
	<hr/>	<hr/>

In addition to the above items, draining will be required on wet ground, and rabbit-netting on ground where rabbits exist, which will add from 25s. to 30s. to the expense in each case, or 15s. to 20s. for draining, and 7s. 6d. to 10s. for netting, bringing the total cost of I. to £8 10s. and II. to £5 15s. per acre when these two items are added.

Fencing.—It is seen that the chief differences in the two estimates are found in the items dealing with cleaning the ground and the cost of plants and planting. The latter item is lower in the case of II., because it is assumed that smaller plants can be used and the planting effected by slitting instead of pitting. In both cases, however, the estimated cost of the plants is much lower than prices prevailing at the present time, as it is taken for granted that large quantities would be dealt with, and that seed would be sown or seedlings lined out in a local nursery established for the purpose. It is also assumed that only the cheaper or commoner species would be planted, such as Scotch pine, spruce, or birch. The uncertain items in both estimates are those which refer to fencing and the beating up of the ground to replace dead plants. Without knowing the actual size and form or outline of the areas it is impossible to make a correct estimate for fencing, but the sum allowed is based upon the cost of fencing one square mile at the rate of 1s. per yard. The cost of beating up may be saved when planting has been very successful, or in bad seasons, or with careless planting may be the double of that allowed. These

estimates refer to a class of ground upon which planting is most frequently carried on, but many other conditions of soil and situation may be met with which often come within the sphere of the planter, although it is impossible to deal with them here. It may be of interest, however, to consider one or two items of expenditure which are sometimes omitted or reduced in amount in the hope of effecting a saving in the total cost. These reductions are often made on draining, rabbit-netting, the size and number of plants used per acre, the method of planting, and the beating up of the original crop.

Drainage.—In the case of draining, fewer and shallower drains are often made than will suffice for the removal of all stagnant moisture in the ground. The result of this is usually a large number of sickly trees during the first ten years of the plantation's life, and many of these never recover their vigour, and others succumb to diseases of one kind or another. Rabbit-netting is often omitted from the fencing of a plantation altogether, or erected of a cheaper and less effective kind than the circumstances require. The result is that rabbits gain entrance from adjoining ground in increasing numbers year by year, while those first on the ground increase there unless constantly trapped or snared. Fewer plants are often put into the ground to begin with than are necessary for producing clean timber, ground which is adapted only for pit planting is slit-planted with smaller trees than those strong enough to survive amongst long grass and rubbish, while the neglect of proper beating up is more or less universal.

Bad Policy to unduly Restrict Initial Expenditure.—In all such cases the effect of a slight saving in the cost of planting is obvious. Slow and sickly growth, thin and patchy crops, and a general roughness and coarseness of timber result in a loss at the final cutting of £50 to £100 per acre, according to the value and development of the species in question. While an increase of one or two pounds per acre in the cost of planting reduces the net amount gained at the harvesting of the crop by six or twelve pounds, as the case may be, the saving of an equal amount by withholding necessary expenditure may mean the loss of a much greater sum. The true significance of these particular causes and effects is appreciated only,

however, when the fact is considered that the planter of such crops rarely, if ever, reaps them. The planter may personally benefit by any saving on the first cost, but neither gains nor loses on the final returns. Leaving the financial side of the question out of consideration, it is not at all probable that a landowner who plants for the benefit of his estate or heirs will consider money ill-spent, which leads to the successful termination of his efforts at improvement; or money judiciously saved, which leads to their failure. Planting on bare or waste land must be largely considered as a process of reclamation, and if it is effected at a small profit only on the first crop should pave the way for more profitable results later on.

British and Continental Conditions differ.—It is evident that estimates which put the cost of planting land as low as £2 to £3 per acre must apply to exceptional conditions of soil and situation, or must miss out several important items of expenditure. It is probable, however, that many of them are simply quotations from Continental publications, in which case, the low figures can be easily explained. In the first place, fencing and rabbit-netting will not be allowed for, the plants used will be largely, if not entirely, raised directly from seed in local forest nurseries, and the labour employed will be cheaper and probably more efficient than that procurable in the British Isles. Here much forest planting is done by men who have had no previous experience in this work, and although the planting of trees can be learned in a few minutes, it requires several weeks' practice before a man can plant rapidly and skilfully, and many plants are badly put in during the process of affording him experience.

WITCHES' BROOMS.*

WITCHES' Brooms are irregular tufts of twigs often found among the branches of trees such as birches, hornbeams, etc., where they look like crows' nests; and similar structures are to be found on silver firs and other

* This and the following statement refer to specimens exhibited by the Earl of Yarborough at the Royal Agricultural Society's Show, Lincoln. Mr. W. B. Havelock prepared the specimens, and it must have cost him much time and labour to do so.

conifers. In the former case they are due to *Exoascus*, in the latter to other fungi, which are perennially parasitic in the shoots, and stimulate the twiggy development of a number of buds which would normally have remained in abeyance, or not have been formed at all, and only do so now in a fashion different from that of normal branches ("Disease in Plants," by Marshall Ward).

The following fifteen varieties of Witches' Brooms have been collected in the Brocklesby Woods. Some of them are very rare, and in certain kinds the fungus which has caused their growth has not yet been identified :—

Ref. No.	Species.	Cause of Broom.
15	WILD CHERRY (<i>Prunus Avium</i>)	<i>Exoascus Cerasi</i>
17	LIME (<i>Tilia europæa</i>)	Cause unknown
21	BIRCH (<i>Betula alba</i>)	<i>Exoascus turgidus</i>
22	BEECH (<i>Fagus sylvatica</i>)	There are two kinds found on Beech. The small one is probably caused by a species of <i>Exoascus</i> . The cause of the large one is not known
28	WHITE THORN (<i>Cratægus Oxyacantha</i>)	<i>Exoascus Cratægi</i>
31	NORWAY SPRUCE (<i>Picea excelsa</i>)	Cause not definitely known
32	LARCH (<i>Larix europæa</i>)	Cause not known
33	SCOTS PINE (<i>Pinus sylvestris</i>)	Cause not definitely known
37	HORSE CHESTNUT (<i>Æsculus Hippocastanum</i>)	Cause not known (very rare)
40	SILVER FIR (<i>Abies pectinata</i>)	<i>Aecidium elatinum</i> (<i>Melampsorella Caryophyllacearum</i> , Schröter)
44	WYCH ELM (<i>Ulmus montana</i>)	Cause not known
59	ELDER (<i>Sambucus nigra</i>)	Cause not known (very rare)
60	HORNBEAM (<i>Carpinus Betulus</i>)	<i>Exoascus Carpinii</i>
69	OAK (<i>Quercus pedunculata</i>)	Cause not known (very rare)
163	INDIAN SILVER FIR (<i>Abies Webbiana</i>)	Cause not known

THE CREOSOTING OF HOME-GROWN TIMBER.

RESULT of tests to ascertain absorption of creosote oil under high pressure, by twenty-seven kinds of timber (in the round) grown on the estate of The Right Hon. The Earl of Yarborough, Brocklesby Park, Lincolnshire. The timber was felled in December, 1906, cut into 8 feet lengths and weighed with the bark on, on January 21st, 1907. The bark was then taken off and the timber weighed and stored outside, protected from rain, until May 29th, 1907, when it was weighed again and placed in the creosoting cylinder. After a vacuum of 9 lbs. had been maintained for some time in the cylinder, the oil was injected and kept under a pressure of 85 lbs. per square inch (about 6 atmospheres) for three hours. The creosote oil (sp. gr. 1,040, costing $3\frac{1}{4}d.$ to $3\frac{1}{2}d.$ a gallon delivered at the purchaser's yard), was warmed by steam during use. The last column of figures shows the absorption of creosote per cubic foot of the wood impregnated. As soon as the timber was taken out of the cylinder it was weighed, and one piece of each kind sawn longitudinally through the centre in order to ascertain to what extent the oil had penetrated.

THE CREOSOTING OF SAWN TIMBER.

Ref. No.	Description.	No.	Size.	Total cubical contents.	Weight before creosoting.	Weight after creosoting.	Oil absorbed by each.	Oil absorbed per cubic foot.	Remarks.
31	Spruce Hunting Gate Posts	6	8 ft. x 7 in. x 7 in.	Cu. ft. 18'00	Lbs. 679'30	Lbs. 832'75	Lbs. 25'54	Lbs. 8'31	Timber been felled 2 years.
31	Spruce Field Gate Posts	6	8 ft. x 8 in. x 8 in.	22'66	807'25	1021'00	35'62	9'43	" "
31	Spruce Fence Posts ...	13	10 ft. x 7½ in. x 5 in.	32'90	1186'75	1464'25	21'80	8'72	" "
31	Spruce Rails	24	8 ft. x 4 in. x 2 in.	10'62	340'00	508'00	7'00	15'90	" "
31	Spruce Pales	36	7½ ft. x 3 in. x 1½ in.	7'03	234'25	359'00	3'46	18'21	" "
31	Spruce Pales	36	5½ ft. x 3 in. x 1½ in.	5'15	163'75	253'00	2'48	17'71	" "
31	Spruce Boards	24	6 in. x 1 in.	sq. ft. 108	289'25	443'00	—	pr. sq. ft. 1'42	" "
32	Larch Hunting Gate ...	1	4 ft. 11 in. x 4 ft. 5 in.	—	65'00	72'25	9'25	—	Thoroughly seasoned : ber.
69 & 32	Oak and Larch Paled Gate	1	10 ft. x 4 ft. 8 in.	—	155'00	196'00	41'00	—	" "
32 & 31	Larch Gates with Spruce Boards	3	3 ft. x 2 ft. 1½ in.	—	99'00	113'50	4'83	—	" "

The next two pages refer to round pieces of timber.

352 The Creosoting of Home-grown Timber.

Reference Number	Species of Timber.	Number of Pieces.	Length.	Quarter Girths after removal of Bark.	Total cubical contents under Bark.	21st Jan., 1907.	21st Jan., 1907.	28th May, 1907.
						Weight before removal of Bark.	Weight after removal of Bark.	Weight before being Creosoted.
			Inches.		Cu. Ft.	Lbs.	Lbs.	Lbs.
113	MONKEY'S PUZZLE ... (Araucaria imbricata) ...	1	8	6	2'00	232'00	178'25	86'50
8	AUSTRIAN PINE ... (Pinus Laricio-austriaca) ...	3	8	7½, 7½, 6½	8'21	735'25	661'50	461'25
82	HIMALAYAN PINE ... (Pinus excelsa) ...	2	8	4, 5½	2'41	179'00	157'50	78'50
33	SCOTS PINE ... (Pinus sylvestris) ...	3	8	6½, 7, 7½	8'22	692'50	654'00	455'00
89	CORNICAN PINE ... (Pinus Laricio) ...	3	8	6, 7, 7	7'44	652'00	583'25	416'50
44	WYCH ELM ... (Ulmus montana) ...	3	8	5½, 5½, 6	5'51	435'50	372'00	223'50
22	BEECH ... (Fagus sylvatica) ...	2	8	6, 6½	4'52	423'50	408'00	295'50
60	HORNBEAM ... (Carpinus Betulus) ...	2	8	5½, 7	4'55	393'50	373'25	297'00
7	HOLLY ... (Ilex aquifolium) ...	2	8	5½, 6½	3'84	350'50	325'50	253'50
21	BIRCH ... (Betula alba) ...	2	8	5½, 7	4'55	384'00	341'00	271'00
47	JAPANESE CEDAR ... (Cryptomeria japonica) ...	4	8	3, 4, 6, 6	5'39	348'00	324'00	162'00
70	ASH ... (Fraxinus excelsior) ...	3	8	5½, 6½, 6½	6'52	508'50	449'00	409'25
155	TREMBLING ASPEN ... (Populus tremula) ...	1	8	5½	1'84	158'00	120'00	93'50
66	LAWSON'S CYPRESS ... (Cupressus Lawsoniana) ...	3	8	3½, 4½, 4½	3'05	237'25	213'00	122'00
35	RED ELM ... (Ulmus campestris) ...	3	8	5½, 6½, 7	6'75	653'75	568'25	436'00
19	DOUGLAS FIR ... (Pseudotsuga mucronata) ...	3	8	5½, 6½, 6½	6'34	486'50	436'00	281'75
40	SILVER FIR ... (Abies pectinata) ...	3	8	5½, 5½, 6½	5'70	550'00	489'75	322'50
34	SYCAMORE ... (Acer Pseudo-platanus) ...	3	8	6, 6, 6½	6'52	588'75	537'25	395'50
81	NORDMANN'S FIR ... (Abies Nordmanniana) ...	3	8	4½, 5½, 6	4'52	363'00	319'00	214'00
32	LARCH ... (Larix europæa) ...	3	8	5½, 6½, 7	6'72	487'50	434'00	332'00
13	CEDAR OF LEBANON ... (Cedrus Libani) ...	3	8	5½, 5½, 6½	5'86	535'00	458'50	288'50
104	ORIENTAL SPRUCE ... (Picea orientalis) ...	2	8	4½, 5½	2'65	244'00	223'00	112'75
46	MOUNT ATLAS CEDAR ... (Cedrus atlantica) ...	1	8	7	2'72	275'50	242'00	156'50
102	HIMALAYAN SPRUCE ... (Picea Smithiana) ...	2	8	3, 4½	1'50	154'50	131'00	65'75
31	NORWAY SPRUCE ... (Picea excelsa) ...	3	8	6, 6½, 7½	7'44	567'50	523'00	318'00
14	MENZIES SPRUCE ... (Picea Sitchensis) ...	1	8	7	2'72	220'00	202'50	117'00
80	WHITE SPRUCE ... (Picea alba) ...	2	8	5½, 7½	4'60	387'00	337'00	221'00
27	Species	66	...	...	130'09	11242'50	10062'00	6889'25

The Creosoting of Home-grown Timber. 353

3rd June, 1907. Weight after being Creosoted.	Total Increase in Weight.	Weight of Creosote Oil absorbed per cubic ft.	Species of Timber.	Reference Number.	Notes on Penetration of Creosote.
lbs.	lbs.	lbs.			
148'00	61'50	30'75	MONKEY'S PUZZLE ... (Araucaria imbricata) ...	113	Completely saturated 4 to 6 inches from both ends, only little from sides.
665'00	203'75	24'81	AUSTRIAN PINE ... (Pinus Laricio-austriaca) ...	8	Saturated more or less the whole length, but least in heartwood.
137'00	58'50	24'27	HIMALAYAN PINE ... (Pinus excelsa) ...	82	Saturated nearly full length.
654'75	196'75	23'93	SCOTS PINE ... (Pinus sylvestris) ...	33	Saturated 3 feet from both ends, and 2 inches from sides, not much in heartwood.
594'50	178'00	23'92	CORSICAN PINE ... (Pinus Laricio) ...	89	Saturated nearly full length, but not quite through the heartwood.
351'00	127'50	23'13	WYCH ELM ... (Ulmus montana) ...	44	Saturated 12 inches from both ends, and also little from sides.
383'00	87'50	19'35	BEECH ... (Fagus sylvatica) ...	22	Completely saturated 3 feet at each end and partly so in the middle.
385'00	88'00	19'34	HORNBEAM ... (Carpinus Betulus) ...	60	Saturated 2 feet from each end and 1 to 2 inches from each side.
319'00	66'00	17'18	HOLLY ... (Ilex aquifolium) ...	7	Saturated 2 feet at each end and also a little from sides.
320'00	49'00	10'76	BIRCH ... (Betula alba) ...	21	Saturated 6 inches from each end and about 1 inch from each side.
212'00	50'00	9'27	JAPANESE CEDAR ... (Cryptomeria japonica) ...	47	Saturated 9 inches from each end and a little from the sides, none in the centre.
468'25	59'00	9'04	ASH ... (Fraxinus excelsior) ...	70	Saturated 6 to 12 inches from each end, also 2 inches from the sides.
109'25	15'75	8'55	TREMBLING ASPEN ... (Populus tremula) ...	158	Saturated 12 inches from each end and very irregularly the full length.
145'75	23'75	7'78	LAWSON'S CYPRESS ... (Cupressus Lawsoniana) ...	66	Saturated about 1 foot from each end, none visible from the sides.
482'25	46'25	6'85	RED ELM ... (Ulmus campestris) ...	38	Saturated 18 inches from the ends only.
319'00	37'25	5'87	DOUGLAS FIR ... (Pseudotsuga mucronata) ...	19	Partly saturated 12 to 18 inches from the ends, very little from the sides.
353'00	30'50	5'35	SILVER FIR ... (Abies pectinata) ...	40	Very little perceptible from ends and sides, but the oil has penetrated the pith.
428'00	33'00	5'06	SYCAMORE ... (Acer Pseudo-platanus) ...	34	Partly saturated 15 inches from the ends, scarcely perceptible from the sides.
235'50	21'50	4'75	NORDMANN'S FIR ... (Abies Nordmanniana) ...	81	Very little from either the ends or sides.
359'50	27'50	4'09	LARCH ... (Larix europaea) ...	32	Penetrated a short distance from the ends, and about 1/2-inch from the sides.
311'00	22'50	3'84	CEDAR OF LEBANON ... (Cedrus Libani) ...	13	Partly saturated 9 inches from ends and not perceptible from the sides.
122'50	9'75	3'67	ORIENTAL SPRUCE ... (Picea orientalis) ...	104	Partly saturated 12 inches at each end and scarcely discernible from the sides.
164'75	8'25	3'03	MOUNT ATLAS CEDAR ... (Cedrus atlantica) ...	46	Partly saturated 12 inches from the ends and scarcely perceptible from the sides.
70'25	4'50	3'00	HIMALAYAN SPRUCE ... (Picea Smithiana) ...	102	Partly saturated 6 inches from the ends, scarcely any from the sides.
338'75	20'75	2'78	NORWAY SPRUCE ... (Picea excelsa) ...	31	Partly saturated 6 inches from each end, none perceptible from the sides.
124'00	7'00	2'57	MENZIES SPRUCE ... (Picea Sitchensis) ...	14	Partly saturated about 9 inches from the ends, none perceptible from the sides.
229'50	8'50	1'84	WHITE SPRUCE ... (Picea alba) ...	80	Traces only for 12 inches at each end, none elsewhere.
8431'50	1542'25	11'85		Totals	

W. B. HAVELOCK.

Reviews and Notices of Books.

"THE TREES OF GREAT BRITAIN AND IRELAND." *

The second volume of this important work has recently appeared, and in every way keeps up the high standard of excellence which characterised the previous volume. In this part *Thujaopsis*, *Aesculus*, *Tsuga*, *Juglans*, *Quercus Robur* (including pedunculate and sessile oak), *Larix*, *Pinus Laricio*, *Gymnocladus*, *Pterocarya* and *Cladastria* are described and beautifully illustrated by from sixty to seventy plates. Of *Thujaopsis dolobrata*, Sieb. and Zucc., a new variety, *i.e.*, *australis*, Henry, is described; it is the form commonly in cultivation. This and the var. *Hondai* are natives of the main island of Japan. Of the genus *Aesculus* five species of the section *Hippocastanum* and four of the section *Pavia*, one of *Macrothyrsus* and two of *Calothyrsus*, are enumerated. The horse-chestnut, a native of Northern Greece, was first introduced into Western Europe from Constantinople, the first tree being raised from seeds sent by the Imperial Ambassador in 1576 to Clusius at Vienna. Clusius refers to it in 1601, and Johnson in his edition of Gerard's "Herbal," published in 1633, says that a tree was growing in Tradescant's garden in South Lambeth. The authors point out the extreme hardiness of this native of South-Eastern Europe by the fact that it grows to a large size as far north as Trondhjem in Norway, and at Christiania a tree 28 metres high exists which has been exposed to as low a degree of cold as 18° to 20° Reaumur. A tree grows at Invercauld, in Aberdeenshire, at an elevation of 1,110 feet. Three trees at Mr. Elwes' park at Colesborne attain a height of 105 feet, but the one at Lord Dynevor's seat in Carmarthenshire is 109 feet, by 17 feet 9 inches in girth, and from height and girth combined appears

* By H. J. Elwes, F.R.S., and A. Henry, M.A., Reader in Forestry, University of Cambridge. Privately printed, 1907. Vol. ii., copiously illustrated. For copies apply to Mr. J. Edwards, Colesborne, Gloucestershire.

to be the largest tree in Britain. Actually taller is a chestnut in Petworth Park, in Sussex, which is between 115 and 120 feet high. A beautiful illustration is given of the weeping horse-chestnut at Dunkeld, which is 80 feet high with a girth of $17\frac{1}{2}$ feet.

Aesculus carnea is said to be a hybrid of the horse-chestnut with *A. Pavia*, although at Kew (according to Mr. Bean) it has come true from seed, and *A. indica* is described, the latter in its native home attaining a height of 150 feet, and occurring at elevations of from 4,000 to 10,000 feet. A fine plate of the tree grown at Barton in Suffolk, 66 feet high, is given, and it is stated that it did not suffer from the severe winter of 1860. The Japanese horse-chestnut, *A. turbinata*, the Ohio buck-eye, *A. glabra*, its allies *A. octandra*, the sweet buck-eye, and *A. californica* are also described. The latter is recommended for the beauty of its flowers, which appear in June and July.

Seven species of *Tsuga* are given. Hooker's hemlock, *T. Pattoniana*, the *T. Mertensiana*, Sargent, has a range in North America similar to that of the western hemlock, but extending farther south in California, is usually found at high elevations, but descends to the sea-level in Alaska and on Baranoff Island. The fine trees at Murthly Castle are figured on Plate 67, the tallest attaining a height of 47 feet. The western hemlock, *T. Albertiana*, which, if the Vienna rules be adopted, should be known as *T. heterophylla*, attains a height in America of 250 feet and forms the greater part of the great west coast forest which reaches from the sea-level to 2,000 feet, but Elwes on his visit to Mount Rainier was not able to find a tree exceeding 200 feet. At the Earl of Selborne's seat at Blackmoor in Hants several self-sown trees occur. The tallest tree mentioned in Britain is that at Hafodunos in Denbighshire, which is 94 feet 6 inches; the tree at Dropmore, which is figured, is $70\frac{1}{2}$ feet high, but is a beautiful specimen, and there is another excellent plate from the Murthly Castle tree. The hemlock or hemlock spruce, *T. canadensis*, so often alluded to by Longfellow, was introduced into England by Peter Collinson in 1736. The most remarkable specimens in Britain are those figured at Foxley, Herefordshire, but the Studley

Royal tree is 80 feet high, and the one which is figured from Strathfieldsaye is 75 feet, "the branches weeping to the ground on all sides." The other species alluded to are *T. Brunoniana*, the Himalayan hemlock, *T. Caroliniana*, *T. Sieboldii* and *T. diversifolia*, the two last being Japanese species.

The walnut, *Juglans regia*, with eleven varieties and two hybrids, is next described, and some very interesting and valuable information given as to its propagation and culture. Allusion to some self-sown trees is made. A magnificent tree is figured (Plate 74) from Barrington Park near Burford, which is over 80 feet high with a girth of 17 feet. The black walnut, *J. nigra*, a native of North America, which was introduced to England by the younger Tradescant and described by Parkinson in his "Theatrum" of 1640, is one of the finest trees in its native country. The Twickenham tree is 98 feet high, while the one at The Mote, in Kent, is over 100 feet. Excellent plates of both trees are given.

The common oak is treated under the names of *Quercus pedunculata*, Ehrh. (the *Q. Robur*, L.) the durmast oak, *Q. sessiliflora*, Salisb., which are the British forms, and *Q. lanuginosa*, the pubescent oak, a native of southern and eastern Europe. We believe that in Britain we have undoubtedly two species, and are glad to find that the authors consider them as distinct species. They occupy different localities, the pedunculate oak being the oak of low-lying situations on moist soil, while the sessile oak is the tree of drier, rocky, and more elevated situations. In Ireland the authors consider the sessile as the indigenous species. Most valuable information is given by the authors on the propagation and culture of the oak, and of its rate of growth. No fewer than eighteen plates are devoted to illustrate the monarch of the forest. The champion oak, which Mr. Elwes believes to be the largest tree in Britain, is at Powis Castle, in Montgomeryshire; it is 105 feet high and 31 feet 7 inches in girth, with cubic contents of 2,026 feet. A younger tree, represented in our frontispiece, at Whitfield Park, Herefordshire, measured 130 feet high. Two others at Kyre Park, Worcestershire, are also over 130 feet high. Among the trees of Windsor

Park allusion is made to the Conqueror's oak, which is now a wreck. A beautiful tree from Earl Spencer's Park at Althorp, Northamptonshire, is figured; it is 90 feet high and contains over 1,000 feet of timber. The Salcey oak, in the same county, was a mere wreck in 1822, though I believe it still exists (I photographed it about ten years since). The authors give 1,200 feet as the extreme altitude at which the oak is found in Scotland, but Sir Joseph Hooker gives 1,350 feet. A fine tree at Blair Drummond, Perthshire, is 118 feet high. The roof of Westminster Hall has by some authorities been stated to be of Spanish chestnut, but the authors state that it is the sessile oak which has supplied the timber, and in older buildings this is the more frequent timber used. Tradition has also said that Shillelagh in Ireland afforded the timber for Westminster Hall, as well as the roof of King's College, Cambridge. At any rate, the name Shillelagh applied to the blackthorn appears to have been most unfairly taken from the oak.

Fourteen species of *Larix* are alluded to. The name *L. europæa* DC. is adopted instead of the older *L. decidua*, Miller, for the common species, which was mentioned by Parkinson in his "Paradisus" of 1629 as a rare tree. An excellent account of the forestry of the larch is given as well as of the diseases to which it is unfortunately subject. Beautiful specimens of the larch from Oakley Park, Taymouth, and Dunkeld, are given. Some specimens from Croft Castle, Herefordshire, were nearly 150 feet high, and at Ombersley Court, Worcestershire, a tree exists which at 5 feet from the ground has a girth of 15 feet 7 inches. Kerner gives the tallest tree in Silesia to be 176 feet. *Larix dahurica* is figured from the tree at Woburn and the Japanese larch from Earl Ducie's Park, at Tortworth. *L. Griffithii*, the Sikkim larch, is represented in a plate of a tree from Strete Raleigh, Devonshire, the Tamarack, *L. Americana*, at Dropmore is 78 feet high, but the tree there has no great beauty. *L. occidentalis* and *L. Lyallii*, the latter from Alberta, are also figured.

Pinus Laricio, of which the Corsican pine is the finest form, since it attains a height of 150 feet and forms magnificent forests in that picturesque island, where the writer has seen it

358 "Preservation of Timber from Rot."

in some instances much affected by mistletoe. It is there very slow-growing, since a tree 5 feet in girth in Corsica is often 700 years old. The specimen near the entrance to Kew Gardens, which is said to have been brought to England by Salisbury in 1814, is nearly 87 feet high. Specimens growing on the sandhills, where it reproduces itself, at Holkham, in Norfolk, are illustrated. *P. austriaca* is also described as well as *P. leucodermis* from Bosnia; the latter is easy to raise and transplant.

The Chinese soap tree, *Gymnocladus chinensis* and the Kentucky coffee tree, *G. canadensis*, the latter of which will be figured in the next volume, are described, there are two trees at Claremont, the largest of which is 60½ feet high. *Cedrela sinensis*, of which a tree in Kew Gardens is 33 feet high, is mentioned. Of *Pterocarya* three species are described, *P. caucasica* being stated to be one of the most ornamental hardwoods we have, a tree at Melbury, Dorsetshire, being 90 feet high and 11 feet in girth, the illustration of this species is of the tree at Claremont Park, Surrey. The volume concludes with an account of the yellow-wood, *Cladrastis tinctoria*, one of the rarest trees of the American forest; the illustration given is that of the grand specimen from Syon House, which is no less than 60 feet high. The two other species mentioned are *C. amurensis* and *C. sinensis*.

From this account it will be seen how wide a ground is covered by this fascinating volume, on the production of which the authors deserve the sincerest thanks and congratulations of all interested in the great subject they have so successfully grappled with.

J. C. D.

"PRESERVATION OF TIMBER FROM ROT."

E. HENRY.

This little volume deals with the relative value of various antiseptics now in use for rendering timber immune from the attacks of fungi or insects. Experiments have been continued

* "Préservation des Bois contre la pourriture par le sol, les champignons et les insectes. Recherches sur la valeur comparative de divers antiseptiques." E. Henry, Professeur à l'Ecole Nationale des Eaux et Forêts. Berger Levraut et Cie., Paris, 5, Rue des Beaux-Arts, 1907; 96 pages, 10 illustrations

for three years at the Nancy Forest School with the above object in view, and this period has sufficed to show the inutility of certain so-called antiseptics. The experiments are being continued, the specimens being placed in the best approved *pourrissoirs*, so that at length the victory of the best of the antiseptics will be established.

Wood is so superior to iron for many purposes that, though it is attacked by many fungi, its durability is almost indefinite when properly protected. If iron were not protected against moisture it would soon become a mass of rust, why then should not wood be protected against fungi, and it will last as long as iron? Large factories, railway companies, protect their wood by complicated apparatus, in which antiseptics are injected into its substance by exhausting the air and by pressure, with excellent results; but such apparatus are too costly for the ordinary person for whom simple processes suffice, and it is with these that this book deals.

1. A good antiseptic must not only destroy pre-existing germs, but also prevent the development of fresh ones from outside, and this indefinitely if possible.

2. A good antiseptic must not reduce the strength of the wood, nor its elasticity, hardness, etc.; it should either leave them as they are naturally or increase them.

3. The substance must penetrate easily into the tissues of the wood, and must, at any rate, partially remain there.

4. It must not be poisonous nor dangerous to deal with, especially if it is to become of general use.

5. Its composition must be constant and well-defined.

6. It is advisable, in certain cases especially, that the substance should not have a strong disagreeable odour, and that it should not change, or very slightly change, the colour of the wood.

7. The price of the substance must not be excessive.

The substances tested are :—

1. Carbolineum Avenarius.
2. Carbolineum Marque de Lion.
3. Coal-tar.
4. Microsol.
5. Antinomine.

6. Antigermine.
7. Lyrol.
8. Hydrofluoric acid.

It would not be fair to the author that the results of his investigations were given here in detail. Each of the above substances is considered from the seven points of view enumerated above, and for broadleaved and coniferous wood in each case, and the results are given in detail. The specimens of wood to be tested were placed in dung, in garden soil, and in an iron mine.

The book terminates with a series of full-page illustrations from photographs of the specimens, which show in each plate pieces of injected and uninjected wood after subjection to the same test of durability.

MATHEY'S "COMMERCIAL UTILISATION OF TIMBER."*

This book is the first volume of a treatise on the utilisation of timber and deals with its structure, defects, and diseases, preservative processes, its exploitation and transport. Mathey proposes to publish a second volume dealing with the chief uses of timber, the methods of conversion of timber in the round, its value, and the commercial practices in France and abroad. An introduction by Daubrée, *Directeur général des Eaux et Forêts*, warmly recommends the book to the public.

The first chapter, dealing with the structure of wood, follows Gayer's great work, "Forstbenutzung," the 9th edition of which, rewritten and brought up to date by Heinrich Mayr, appeared in 1903, and is based on the microscopic examination of wood-sections by the eye and simple lens without using the microscope; the plates here are taken from Gayer's book, and his system of classification of wood is followed. The second chapter, dealing with the physical properties of wood, is

* "Traité d'exploitation commerciale des bois." Tome premier. Alphonse Mathey, Inspecteur des Eaux et Forêts. Paris, Lucien Laveur, 13, Rue des Saints Pères. 1906; pages i.—xiii., 488 including index. 377 illustrations, 8 being chromo-lithographs.

also largely taken from Gayer. Then follows the chemical constitution of wood and its various qualities.

The second part of the book treats of the defects and diseases of wood, the plates of fungoid diseases being coloured and drawn by the author from specimens taken from French forests. These illustrations are particularly good. The third part deals with methods of preserving timber, either by seasoning it or by injection, and of storing it. The fourth part gives methods of felling, conversion and clearing, with statistical tables showing the amount of work that can be done by a woodman in a given time and the cost of the operations. Various forest implements are also described. The last and longest of the divisions of the book deals with the transport of material from the forests to the centres of industry, by means of carts, floating and rafting, sledge-roads, slides, wire-tramways (*tél ferage*), ordinary tramways (*porteurs*), canals and railways. The book terminates with an account of the railway-rates for the transport of wood throughout France. This is certainly the best work of the kind in the French language, differing from Gayer's work chiefly in the omission of any reference to minor produce. A list of the authors consulted and a good index is included.

TRANSACTIONS OF THE ROYAL SCOTTISH ARBORICULTURAL SOCIETY, JULY, 1907.

THIS, the second six-monthly part of the transactions of the senior arboricultural society of Great Britain, is a very good number. The new president, Sir Kenneth T. Mackenzie, Bart., of Gairloch, delivered an excellent address on February 5th. He advocated State help for a school of forestry and an experimental area in Scotland. He shrank from estimating how many acres of land there are at present in Scotland rented at 1s. to 3s. per acre for grazing purposes, but which are not too rocky, too steep, nor at too high an elevation to prevent their producing a crop of larch worth at least £90 an acre in 70 or 80 years. Even a small area, such as 20,000 acres of such land, under a timber-crop, will maintain a great many more

families in comfort than it will as a grazing area. It then increases the assessable value of the locality, and thus benefits the State, the parish, the district and county, and would benefit the landowner if the capital with which to face the initial outlay could be obtained at as cheap a rate as capital already advanced by the State for several other purposes.

Mr. A. C. Forbes' paper on the value of waste land for afforestation purposes, that was read before the Royal Scottish Arboricultural Society on August 1st, 1906, is given *in extenso*, and a better paper on the subject has never been written. Mr. Forbes is very cautious on the financial aspect of the question. "While admitting that there are other features connected with arboriculture which are of equal importance as its financial success, and that instances of undoubted authenticity have been given of areas of waste land being planted and yielding crops of timber the value of which has exceeded the cost of producing them, and left something substantial over, he would like to see such records of compact plantations of several hundred acres in extent having given a net return of any definite sum per acre after allowing compound interest on all items of income and expenditure. If such a statement could be produced it would go a long way towards establishing such proof as we require to make out a conclusive case for afforestation."

Mr. Forbes suggests the lines to be followed in detail for arriving at definite conclusions in this matter, not referring to the planting of small areas, but to the wholesale but gradual afforestation of a tract of country of several thousand acres. He gives some very useful instances of a beginning made by himself to collect statistics of tree-growth in the North of England. His whole paper deserves careful study, and his conclusion is that the probabilities are that timber-crops of spruce and pine can be grown profitably up to 1,500 feet on suitable soils and aspects, and where shelter from wind is obtainable by higher altitudes to the west. On westerly aspects, the 1,000 feet contour line probably marks in a general way the limit of profitable tree-growth. Timber-growing in blocks of about 1,000 acres will then pay, provided a minimum price of 10s. a load is obtainable for the wood.

Should the long-threatened timber famine be upon us there is every prospect of such a price being obtainable for timber offered under proper conditions and in sufficient quantities to allow of economies being effected in handling and conversion. The editor's own experience in Scotland has proved that beech will grow well up to the 1,000 feet limit, and that the addition of this tree to coniferous crops benefits them exceedingly, and makes them more wind-firm, while the great value of its timber when grown in sufficient quantities has been proved in the Chiltern Hills; at Dunblane, in Perthshire, it sells at 1s. per cubic foot, while spruce fetches only 6d., and Scotch pine, 3d.

Colonel F. N. Innes contributes a paper termed "A century of Forestry, 1806—1906, on the estate of Learney, Aberdeenshire, with 1,589 acres under wood." The records on such an estate are particularly valuable. There are many other interesting papers in the transactions, by Professor Geikie, on soil; by Dr. Lauder, on the utilisation of the nitrogen in the air and in forest soils; on forests and rainfall, by Mr. R. C. Mossman; Arboricultural notes from Portuguese East Africa, by Mr. J. A. Alexander; a session at Eberswalde Forest School, by Mr. A. F. Wilson; Encouragement of private forestry, by Professor Schwappach; the woods of Somerset, by Dr. W. G. Smith; notes on Indian forestry in 1906, by Dr. J. Nisbet; and other papers.

"THE INDIAN FORESTER" FOR MAY, JUNE AND JULY.

The first pages of the May number of the *Indian Forester* contain a notice that the Government of India propose publishing a series of "Forest Records and Memoirs" in the same style as the excellent publications of the Geological Survey of India.

The number also contains an account by E. P. Stebbing of a scale-insect, *Icerya aegyptica*, Dougl. on Teak. There is an article by A. G. Hobart Hampden on the treatment of selection forests without calculating the volume or number of trees of

the annual yield. He says that the number of trees to be felled annually cannot be anywhere accurately fixed, nor, *à fortiori*, the volume, and to attempt to do so may lead to unsilvicultural acts; that it is true economy to fell a tree when it is mature, and it is false economy to fell an immature, thriving, well-shaped tree. Therefore, for species for which the selection system is applicable there is no necessity for expending time and money in making enumerations for working plans, and that improvement fellings based only on cultural considerations in following out which the forest is constantly improving, are all that is wanted. This article is a very suggestive one, and deserves the full consideration of working-plan officers.

R. S. Pearson gives a carefully written note on the natural regeneration of dhoura (*Anoglissus latifolia*). Full details are given of the annual rainfall in the years 1900, 1901, and 1902. The writer considers that years of drought either killed or injured many dhoura trees, but that it made the injured trees produce masses of fertile seed. The Number also contains some excellent plates of Indian methods of timber transport.

Among the reviews, is that of notes by Dutch foresters on the regeneration of the teak in Java. There is also an account of the stocking of the Harwan stream and Dhal Lake in Kashmir with brown trout from England, and these trout are breeding freely. Frank Mitchell, who is in charge of these fisheries, has trained a staff of Kashmiris to fertilise the ova artificially, so that trout 9 lbs. weight in four years have been caught with the rod, and the Viceroy had the pleasure of eating a trout of 12½ lbs.

The June number of the *Indian Forester* contains an excellent illustrated paper by L. S. Osmaston on the system of agriculture combined with forestry in the Deccan; also the struggle for existence in Burmese forests by Taw Tha, and a report by P. M. Lushington on the tapping of *Ficus elastica* in North Malabar.

The July number of the *Indian Forester* contains a notice by E. Eardley Wilmot, Inspector General of Forests to the Government of India in the career of Sir D. Brandis, and another notice on the same subject by D. E. Hutchins, chief

conservator of Forests in British East Africa and Uganda. Mr. Wilmot has attributed the idea of the *Indian Forester* to Brandis, whereas it was started by Schlich, in 1875. The successful institution of forestry education in Britain is also due to Schlich, and not to Brandis.

A note follows on the growth of mahogany in India by M. Hill. This splendid timber tree grows to a great size in Bengal and produces fertile seed. The author states that a mahogany tree in the Royal Botanic Garden, Calcutta, measures 120 to 130 feet in height and 14 to 18 feet in girth. Why not have measured the tree himself and given its true dimensions? He states that where hundreds of these trees were blown down in 1864, their timber fetched the price of ordinary mahogany. This tree does not appear to thrive in Assam, Burma or Madras, and the Punjab climate is too cold for it. A. L. McIntire supplies a paper on the reproduction of sal from seed. He combats the statement made by Mr. Lovegrove in the April *Indian Forester* that fire conservancy has had a bad effect on sal reproduction in the most semi-tropical areas in Bengal and Assam. The danger is that climbers and inferior species spring up in the sal forests in the absence of fires and suppress the young sal plants, but a series of clearings kept up from three to six years, according to the nature of the locality, appears to be sufficient to give the sal saplings the necessary start in life.

C. E. Fischer proposes the terms *Staddler* for a standard of the rotation of coppice. Surely the accepted English term *Tellar* is good enough. *Stander* for one or two rotations, *Veteran* for one of three, and *Ancient* for one of four rotations, appear to be good.

"THE LONGLEAF PINE IN VIRGIN FOREST."*

The longleaf or yellow pine (*Pinus palustris*, Miller), commonly known in England as pitch pine, occupies a belt of rarely more than 125 miles wide from North Carolina down to

* "The Longleaf Pine in Virgin Forest" G. F. Schwarz. New York, J. Wiley & Sons; London, Chapman & Hall, 1907; pp. 135, 23 illustrations, and 2 diagrams.

Central Florida and westwards towards the Mississippi River. There are some detached areas in Louisiana and Texas to the west of the Mississippi. The loblolly, Cuban, and shortleaf pines also extend over parts of this area, but the longleaf pine is the dominant tree. On low marshy lands near the Gulf it is largely replaced by the Cuban and loblolly pines, but as the surface of the country rises, the sandy hills and plains are stocked with longleaf pine, while the moist depressions are occupied by hardwoods, loblolly pine, and cypress; still further inland, as the country becomes broken and hilly, as towards the Atlantic, the longleaf pine mingles with the mixed hardwood and shortleaf pine of the uplands.

This species will grow only in a moist and warm climate, but Schwarz has not given any meteorological data, nor has he attempted any estimate of the area still existing of this valuable tree, which certainly affords the best coniferous timber in the world. We cannot learn from this book whether any of the area where it grows is held by the State, nor whether any serious measures have been taken to put a limit to its destruction by boring for turpentine, wholesale felling and forest fires.

As regards fires, seedlings under two years old rarely escape, while older ones offer a remarkable resistance to injury by fires. The tree in this respect and in many others greatly resembles *Pinus longifolia* in India, though the timber of the latter is very inferior. About twenty years ago the editor of this Journal grew from seed in India a number of longleaf pine seedlings, but they all succumbed, by damping off, during the moist rainy season of North-West India. They would not probably have supported the frosts of the cold season of that region. It is a pity that Schwarz, with true German thoroughness, had not omitted Chapter IX. on the æsthetics of forestry, and substituted for this matter which would have made his little book a true monograph of the longleaf pine. The illustrations are excellent, especially Fig. 4, representing a young longleaf pine. A seedling pitch pine, just like this, produced from seed by the late Hon. Mark Rolle, has withstood two winters out of doors at Englefield Green, Surrey, and at Tubney, near Oxford, and is still growing at the latter place in the shelter of some oak standards, but with its crown free from shade.

PUBLICATIONS OF THE U.S. DEPARTMENT OF
AGRICULTURE.

Several of these useful publications have been received. Two of them deal with the "Production of Red Cedar for Pencil Wood" and "Brush and Tank Pole Treatments." Other papers will be dealt with in our next number. They include an account of the forest service in the United States by G. Pinchot. The paper by L. L. White, forest assistant, is very valuable. About 315,000,000 pencils are manufactured in the United States annually, and they require 7,300,000 cubic feet of wood, by far the greater part of which is red cedar. The waste in this manufacture is enormous, being 70 per cent. in cubic feet and nearly 90 per cent. in weight. To realise the scarcity of pencil material it is only necessary to visit the cedar mill yards, where old rails and small and knotty logs are now used which would not have been admitted a few years ago. Two species of red cedar are dealt with—the northern form *Juniperus barbadensis*, and the northern form, *J. virginiana*. In commercial use both species are used indiscriminately. The trees almost invariably grow in mixture with hard woods and only rarely with pine. It grows best on fresh, moderately deep, well-drained soil, either of clay, sand, or calcareous sand. Why cannot attempts be made to grow this valuable tree for profit, in the warmer parts of the British Isles, or in some of our colonies?

Carl G. Crawford, the chief of the office of wood preservation, describes experiments of treating seamed poles by the brush and open tank methods. Five preservatives were used in the analysis by the manufacturer and by the engineering department of the American Telephone and Telegraph Company. The results are not yet known, except the quantity of preservatives absorbed in each case.

There is a good review of Brandis' "Indian Trees," by H. H. H., in which some defects in the book are clearly pointed out. Hitherto, only laudatory notices of this work have appeared, and a great sense of duty alone could have induced the reviewer to notice defects in this work, that, like

spots on the sun, could be visible only to a botanist armed with the special apparatus of a first-rate botanical knowledge. These criticisms were written some time before the announcement of the author's lamented death.

"BULLETIN DE LA SOCIÉTÉ FORESTIÈRE DE
FRANCHE COMPTÉ ET BELFORT," JUNE, 1907.

This contains an excellent article by de Gail, Conservator at Epinal, on the new system of French working-plans, which clearly explains the improvements lately adopted in France in this important subject. Emile Mer contributes a paper on pruning silver-fir and spruce. There is an account of a plantation of spruce planted in 1854 at Fays de Lucy, in the Belgian Ardennes; this contained 5,880 solid cubic feet per acre in 1892, and the crop was estimated at the then prevailing price of about 3*d.* a cubic foot, at £77 an acre. In 1907, the crop, fifty-three years old, contained 8,260 cubic feet per acre, and this at 4½*d.* a cubic foot has raised the value to £144 per acre. During the last fifteen years the average annual increment has been about 160 cubic feet per acre.

"BULLETIN OF THE IMPERIAL INSTITUTE":
. VOL. V., No. 2, 1907.

Among other interesting articles, which, however, do not refer to forestry, is an account of the timbers of the Mabira Forest, in Uganda. D. E. Hutchins, formerly Conservator of Forests at Cape Town, has now left that Colony for British East Africa, having been appointed Chief Conservator of that Protectorate as well as of Uganda. The forests on Mount Kenia, a temperate region in the tropics, the mountains attaining an altitude up to 18,000 feet, resemble those of South Africa, and include valuable timber of species of *Podocarpus*, *Juniperus*, and *Callitris*, besides many valuable broadleaved trees, of which Mozaiti or Ibean camphor appears to be the best. There are 1,000,000 acres of this mixed forest and

600,000 acres of bamboo, and the tract can be dealt with so as to bring down timber to the Uganda Railway. We hope to deal more fully with this question in our next number, as Hutchins has written a full report of it for the Colonial Office, but we have not yet seen any account of the forests of Uganda, eighteen timbers from which are described in the present bulletin by Herbert Stone. Many of the specimens submitted to him were in bad condition, partially rotten or worm-eaten, which, he says, may be due to difficulties of collection and transport rather than to inherent deficiencies of the woods. It is important that only perfectly sound samples should be submitted for technical examination, as otherwise a new timber may be unfairly condemned. The best of the timbers described by Stone are sesambya (*Linociera* ?), as hard as oak; Mugaru (*Albizzia Cosiaria*, Welw.), which, being crossgrained, is difficult to smooth, but otherwise works well with all tools; Joge, another *Albizzia* of similar qualities; Muvube (*Chlorophora rustica*, Benth.), wood yellowish brown, extremely hard and durable, and one of the most useful of the Uganda woods; Mubajangabo (*Lanthoxylon* sp.), resembling Cape silver bark; *Openkusa* (species undetermined), wood light in colour, fairly hard and heavy, and very useful. This would serve similar purposes to those for which American birch is applied. The other woods referred to are of no export value.

HUFFEL'S "ECONOMIE FORESTIÈRE": Vol. III.*

The first volume of this treatise deals with the utility of forests, the laws regulating forest estates, forest policy, distribution and character of French forests, statistics. The second volume treats of dendrometry, forest production, and forest valuation. In the present volume, the last of the series, forest management is dealt with under the following headings: Preliminary Ideas; Old Methods of Management; Methods of

* "Economie Forestière." Tome III. et dernier. G. Huffel, Inspecteur des Eaux et Forêts, Professeur à l'Ecole Nationale des E. et F. Paris, Lucien Laveur, 13, Rue des Saints Pères. Pages i.—viii., 21 illustrations. Ten francs.

Management now in Use. The French National Society of Agriculture has awarded gold medals to the first two volumes of this treatise, and the quality of the matter is fully maintained in the present volume.

The preliminary part of the book deals, firstly, with the advantages of working-plans and of a steady annual yield. In all European State and important communal forests, as well as those belonging to colleges and other public establishments, the necessity for a working-plan has been long recognised in France since 1669. In private forests the owner often cuts according to his needs, economising when he can in order to increase the capital of his standing woods, but in all *usufructuary* forests, such as those that are entailed, the necessity of limiting the annual fellings to the natural increment of a normal forest is evident. Should there be an excess of capital, or should there be an insufficient stock of mature trees, a working-plan should be framed so as eventually to produce a normal crop. Any deviation from these lines of treatment would certainly lead to the ruin of the woodland. The matter may also be considered from a timber-merchant's point of view, for with irregular annual fellings the latter either gets more material than he can properly utilise at once, and prices go down, or owing to the uncertainty or insufficiency of the annual yield, he will look elsewhere for his supplies.

Had our colleges and the trustees of our entailed estates managed their woodlands so as to secure a steady annual yield, we should not see so many woodland areas in the British Isles in their present deplorable condition. I know of one important woodland of 2,000 acres where no standard oak is allowed to be felled till its roots are rotten, and where the whole area is filled with superannuated trees, though the demand for the timber is very great, as the price, 3s. per cubic foot, shows. It has been said that the man on the spot is the best judge of what should be done; but the man on the spot, unless he be a trained forester, has different opinions at different times, and the patchwork so often visible in our woods points to a want of continuity of treatment which only a good working-plan can prevent. Lord Yarborough's 5,000 acres of woodland, where fifty acres are felled annually, result from a wise continuous policy

carried out for upwards of a hundred years, and these woods can be steadily improved as time goes on, so that many a landowner must envy him the steady yield of timber and revenue which this implies. It is only because forestry is too often looked upon as a pastime that working-plans made by a trained man are not universal in our woodlands, as amateur forestry must inevitably lead to deplorable results.

Several chapters in this book deal with the calculation of the annual yield of forests (*possibilité*). Annual fellings may be made either by the number of trees felled, by volume, or by area. The two first methods are applicable only to the principal fellings of mature trees, not to thinnings, which should be made always by area with the view of improving the standing crop and only incidentally for revenue. The method by number of trees is still practised in India and America and in our colonies, but except for coppice, and for mountain forests where protection against wind and soil denudation is essential, and where only dead or dying trees should be felled, the method by volume prevails in nearly all well-managed European forests; in the two latter cases, fellings are made by area.

The method by volume necessitates a careful inventory and measurement of the trees of the oldest age-class in a forest, that have to be felled in a given period, say twenty years. Such measurements are costly and require the services of skilled foresters, but they have given rise to all the research made during the last century into the rate of growth and volume of crops of standing timber, and into the normal condition of a woodland crop. Owing to our ignorance, in some cases, especially in mountainous regions, of the proper volume of a normal crop, and to the interference by Nature (storms, snow-break, insect and fungoidal attacks, etc.), it is now considered necessary to revise our calculations of fellable material at short intervals. Volumetric management should always be checked by fixing definite areas, in which the mature timber should be felled within a certain period, an aliquot part of the fixed rotation. Otherwise, if the annual yield is calculated on too liberal a scale, the ruin of the forest may result; while if it be too small, the standing crop becomes unwieldy, and this leads to the felling of only superannuated timber, while the

middle-aged crops necessary for the constitution of a normal forest tend to disappear. Huffel gives several examples with useful diagrams. The same danger of interference with the sequence of the age-classes of normal crops does not occur if the system of felling by area or by the number of trees is followed. For instance, if with a rotation of 100 years and an area of 500 acres we cut 5 acres annually, and it is afterwards found that the area is under 500 acres, owing to necessary alienation of part of it, so that we have felled the whole area in 90 instead of in 100 years, we shall have simply changed the rotation without interfering with the normality of the crops. Similarly if we cut 100 trees annually, supposing that these trees have an average diameter of 2 feet, and the number fixed on is too large, we should at length find no trees 2 feet in diameter to cut, and should have to cut smaller and smaller trees, until we hit upon the proper diameter for the fixed number of trees, so that we have established automatically a normal forest yielding indefinitely 100 trees of $1\frac{3}{4}$ or $1\frac{1}{2}$ feet diameter annually.

French forest management is very conservative, and French foresters attend more to the silvicultural aspect of the question than to the question of obtaining the highest possible pecuniary return from their forests, and one of the subjects treated of at length by Huffel is that of the reserve of one quarter of the yield, especially in communal forests, so as to provide resources when extraordinary expenditure is required for any public work in the commune.

The second part of the book gives a detailed account of the history of old methods of forest management in France, and the last part deals with the new methods. This latter part is full of interest for those who are managing our Indian and colonial forests, and indeed for all forest students.

Official Papers.

AFFORESTATION CONFERENCE IN LONDON.

THE official report of this Conference has been published by Darling & Son, 34—40, Bacon Street, E. (No. 98), and deserves careful study, but the following account of the proceedings is taken partly from private sources, and owing to pressure of space deals chiefly with the speeches made by members of our Society.

In consequence of the following letter from the Secretary to the Association of Municipal Corporations to the Secretary to the Local Government Board, a Conference was held in a committee room of the House of Lords, on June 25th, 1907.

“ Association of Municipal Corporations,
Palace Chambers, 9, Bridge Street,
Westminster, S.W.

January 18th, 1907.

“ AFFORESTATION.

“Several corporations in the country have during the past few years been approached, chiefly, it may be said, by organisations on behalf of unemployed workmen, and urged to advance some afforestation scheme on lands owned by the corporation for public purposes, such as waterworks or sewage-works, and such corporations have, in many cases, felt that they would willingly do something to advance the question of afforestation if it could be proved to be of material help to the unemployed, and that any scheme they might adopt could be carried out without much loss. The corporations find, however, that owing either to the situation, or to the small area of land at their disposal, it is impossible to carry out a scheme of afforestation with any hope of being ultimately recouped to any appreciable extent of the moneys expended by them for that purpose.

374 Afforestation Conference in London.

"Experts' advice on the subject have been taken by some of the corporations, but it is believed with the result above referred to. In November last the matter was brought before my Association, when they passed the following resolution:—

"That this Council expresses its opinion that the time has now arrived when the question of afforestation should be seriously considered by the Government, and that it be referred to the Law Committee to take steps for urging upon the Government the necessity for initiating afforestation schemes."

"And I am directed by the Law Committee to invite your Honourable Board to consider, in the interests of the unemployed and also in the interests of municipalities, whether a National Scheme could be put forward.

"A. GORING PRITCHARD, *Secretary*."

Earl Carrington, K.G., President of the Board of Agriculture, presided; he was accompanied by Mr. John Burns, President of the Local Government Board, Mr. E. Stafford Howard, C.B., Commissioner of Woods and Forests, Sir T. H. Elliot, K.C.B., and Mr. Middleton, of the Board of Agriculture. Among those present were Mr. Harwood-Banner, M.P.; Councillor Brown (Leeds); Mr. H. J. Elwes (President of the Royal English Arboricultural Society); Mr. W. R. Fisher; Mr. A. C. Forbes (Dublin); Mr. R. E. Fox, Town Clerk (Leeds); Mr. Hart (Deputy Town Clerk, Sheffield); Councillor Johnson (Bradford); Alderman Sir Bosdin Leech (Manchester); Mr. S. Margerison (Leeds); Sir Herbert Maxwell; the Mayor of Harrogate; Councillor Ogden (Leeds); Mr. J. Parry (Liverpool); Sir J. Rolleston; Prof. Schlich; Mr. Fraser Story (Bangor), and many others.

LORD CARRINGTON having briefly opened the proceedings,

Mr. JOHN BURNS, M.P., said Lord Carrington and he could claim that they had done all they could to co-ordinate and systematise the beginning of State or municipal afforestation. The practical object of that conference was to endeavour to focus the increasing attention that was abroad, so that they could utilise undeveloped land that was not profitable either for pastoral or for arable purposes, and by so doing to give

employment to unemployed labour and to encourage rural handicraft and industries. He found that there were thirty-four local authorities in England and Wales who owned or leased 90,000 acres. Eight schemes of afforestation were actually at work or had been attempted in some form or other by local authorities. Only 20,000 acres were in woodland. Liverpool, which was now in possession of the largest tract of actual or potential forest land, had 22,000 acres, of which only 640 acres were in woodland. Leeds, Birmingham, Bradford, and Manchester were also developing forest land. Of the 75,000,000 acres of the United Kingdom only 4 per cent. was woodland. The chief difficulties in the way of large schemes of afforestation in this country were, first, the cost of acquiring the land by municipalities which intended to afforest them, and above all the divided ownership of large tracts of contiguous land, which he was informed were essential for afforestation on a large scale. This country ought to produce more than £3,000,000 worth of timber and import less than £30,000,000 worth annually. He thought there was room for a start being made to reclaim "the waste places of the earth" in this country of ours. He believed they were face to face with the necessity of developing certain minor rural industries of which wood provided not only the raw material, but the secondary, and finally the finished product. To encourage rural industries of this kind should be not only their aim but their municipal and national duty. He could assure them that the Local Government Board would co-operate with the Board of Agriculture in any practical scheme of afforestation, and he would be pleased to consider any applications for additional borrowing powers, or for loans, to enable municipalities to acquire suitable land within their existing powers, and to confer with them as to how their existing powers should be more profitably developed on sound business lines. The value of afforestation as a means of providing work for the unemployed had been, in his opinion, exaggerated. (Hear, hear.) Personally, he favoured a School of Forestry in this country. As to Scotland, he thought there was more scope for afforestation there than in any other part of the United Kingdom.

Professor SCHLICH, C.I.E., F.R.S., quoted four examples of the returns from woods in Britain.

1. Data supplied by Mr. H. J. Elwes, F.R.S.:—

Value of land, £8 per acre.

Cost of planting larch, with fencing, £7 10s. per acre.

Annual expenses, 7s. 6d. per acre throughout.

Returns: Thinning at 25 years, value £10 per acre.

 " 40 " " 30 "

 " 60 " " 50 "

Final yield at 100 " " 150 "

Capital taken out of an investment, which gave 3 per cent. interest.

Compound interest yielded by the wood 4·312 per cent. This agrees with the data given in Schlich's pamphlet on Forestry in the United Kingdom, 1904.

2. Data supplied by Mr. H. J. Elwes:—

Value of land, £6 per acre.

Cost of planting, £7 10s. per acre (with fencing).

Annual expenses 7s. 6d. per acre, for 25 years, then only 2s. 6d. per acre, owing to receipt of shooting rent.

Returns: Thinning at 25 years, £10 per acre.

 " 40 " 20 "

Final yield at 60 " 100 "

Result, plantation gives compound interest at $7\frac{1}{2}$ per cent.

3. Data supplied by Sir Herbert Lewis (Wales):—

A larch wood of 208 acres, cut down some years ago. Locality, a stony hillside. Soil, light sandy loam, not deep. Value of land — £7 10s. per acre.

Returns from thinnings, £4,500.

Returns from final felling, at 50 years, £14,500.

As the time when the thinnings were made is not given, they are thrown in with the final yield. Total, £19,000, or per acre, £91.

Rate of compound interest, $5\frac{1}{2}$ per cent., about 1 per cent. more than in the table at page 45 of Schlich's pamphlet.

4. Data supplied by Mr. W. B. Havelock (North Riding Yorkshire):—

Value of land, £7 10s. per acre.

Cost of planting, fencing, etc., £8 per acre

Value of thinnings not known, but the old woodman asserts that several hundred pounds worth have been taken for sale and other purposes. Value of shooting not given. Professor Schlich placed the value of thinnings and shooting as equal to the annual costs.

Age when cut, 75 to 80 years, giving:—Larch 1328 trees, Scots pine 262, Oak 74, Beech 116, Birch 35, Spruce 12, Ash 120. Net receipts, after deducting all expenses of harvesting, selling, etc., £2,835, equal to £157 10s. per acre. Taking the mean between 75 and 80 years, the compound interest equals 3·56 per cent. If the value of the thinnings had been known and introduced into the account, the rate of interest must certainly not have been less than 4 per cent.

These examples show that forestry can be made to pay quite well in Britain, with present prices, if the woods are treated properly and systematically.

Dr. Schlich then, at considerable length, brought forward statistics showing that from 1890 to 1906 the average price of all imported timber had risen 17 per cent., while that of coniferous timber had risen 30 per cent.; also, that there is plenty of room for afforestation on our waste lands; that it will pay, provided suitable sites and species suited to them are chosen, and that planting and thinning be done efficiently and economically.

Mr. S. MARGERISON (Leeds), said: These words of the resolution forwarded by the Municipal Corporations Association in January last, are, in my opinion, true—that “the time has now arrived when the question of afforestation should be seriously considered by the Government,” and so also is the suggestion that there is a necessity for the Government to initiate afforestation schemes.

It is now generally known that there is, both in this country and abroad, a growing scarcity of timber supplies. Vast areas of forests abroad have been destroyed, or their produce converted into lumber, and countries which have been large exporters are finding themselves in danger of shortage for their own requirements. In fact, so far as timber is concerned, the world has been living greatly on its capital and not on its production alone. For many years we have been greatly

and increasingly dependent on foreign supplies, and at the present day our imports of timber are enormous; and this in spite of the fact that we could ourselves grow a large proportion of the timber we require and import.

I am asked to refer specially to the comparative qualities of British and imported timber. Of course it would take a long time to go into this in any full detail, but I have no hesitation in saying that natural conditions here are such as to enable us to grow timber of the species mostly required, of quality equal to that of other countries in similar latitudes—provided the culture of it is done upon sound lines. In the case of broad-leaved trees, it is no empty patriotic boast that there is no oak superior to British oak, and that much foreign oak is vastly inferior. This is borne out both by practical experience shown in modern and ancient examples, and by scientific experiment, some of the results of which are given in the "Minutes of Evidence before the Departmental Committee on British Forestry," at the Board of Agriculture in 1902. I may mention that in some districts small oak poles are used in large quantities as pit-props, chiefly because their superior quality to that of imported props allows them to be used over and over again, and this in the long run makes them cheaper, although in the first instance they cost more. American oak railway-wagon wood, which is inferior to British, is very difficult to procure on this side of the Atlantic at present, because the requirements in the United States are so great as to use nearly all the supply.

Best English ash has no rival which can compete with it in price and quality combined. British beech, sycamore, alder, and birch, all in their own lines, are equal to, and often better than, that imported, and are sold at similar figures. To take beech for instance, of which large quantities are used for making spinning-bobbins, shuttles, tool-handles, clog-soles, etc., in the West Riding and elsewhere, it is found that our hard-grown timber is much superior to soft-grown Continental wood, and repeated trials of the latter have resulted in a return to the use of homegrown material.

As to conifers, I have as yet, after much enquiry and observation, seen no reason why we cannot grow them of equal

quality and in as large crops as those of Continental production, provided the system of culture be somewhat similar. I have in business repeatedly seen and handled spruce (white deal) grown in English woods, which was as free from knots and other defects as any imported timber, and in fact superior to the bulk of what is now in these later days being sent into our ports. Foreign supplies are yearly becoming not only scarcer and more remote, but also of inferior quality. This is a well-known fact. The same may be said of British Scots-pine timber (red deal). Wellgrown British Scots-pine is preferred for constructional work by many important firms to imported deals, and, at present prices, with proper means of conversion, can be produced at less cost. Larch is somewhat of a bogey to foresters, owing to the prevalence of larch disease. But where plantations are free from this in their early years, the larch upon suitable soils and with proper culture makes one of our most profitable timber crops; and with due admixture of other species (especially beech), even in case of attack by disease, a good crop is ensured.

These are the principal trees suitable for culture in British plantations. They are the species most in demand in this country, and although after the experience which is accumulating, other species may be grown profitably, it is well for a time to confine ourselves chiefly to them. Where cheap land, of suitable soil, altitudes and aspects can be obtained, on mountain, moor, or plain, I am convinced that, given as careful attention to detail as we bestow on our agriculture and horticulture, silviculture is still a profitable undertaking, and that it will become more so as prices advance, which in face of the increased cost of foreign timbers, they are bound to do. I do not for a moment say that *all* so-called "waste lands" are suitable for afforestation, but I do say emphatically that, with pecuniary encouragement, there are millions of acres suitable and probably available, and that thereon we can grow a very large proportion of our requirements in timber—millions of pounds' worth a year, and grow it of a quality equal to that which we import. In the case of pit-props we should begin to reap paying crops in fifteen, twenty, or twenty-five years, and as time went on, the main crops would mature and a

succession of falls would follow one another, quite equal to, and in some cases of better quality than, those of foreign lands.

Especially is this the case with cheap lands fairly near to our populous centres, or within reach of present or prospective means of reasonably cheap transport, which is developing all the time. Good timber is grown even within short distances of the intenser smoke areas. Then there is a considerable amount of good land which, for various reasons, is going out of the "intenser" cultivation. This is eminently suitable for the purpose.

It is sometimes urged that forestry does not pay in this country. Where this is the case it is often owing to injudicious planting and faulty methods of management, unsuitable to modern requirements, or to lack of persistence and pluck. A bold, continuous, well-planned policy will pay. Others will give instances, no doubt, but I should like to mention two concrete examples that have come under my own observation during the past few weeks.

One is that of some portions of an old lowland wood of large extent, upon land of a comparatively high value—over a pound per acre, annual rental value. I have known it personally in the way of business for over thirty years. This wood, the crop being ripe, has been gradually cleared during a series of years, and the different sections re-planted. In many sections the work has been indifferently done, and the results of the rest are poor. But one quarter of the area of similar quality as to soil, etc., which we cleared about twenty-eight years ago, was re-planted the following season, chiefly with larch. This was carefully done, and the plantation has been successful; so much so, indeed, that I should not hesitate to give for it, with the prospect of a profit, the cost of planting and compound interest thereon at 3 per cent., together with the whole of the rental value at 22s. 6d. per acre, compounded yearly at the same rate, less the value of the thinnings taken out—and it is now at the age when it will probably do better still. The other instance is again a plantation of larch, but in this case it stands at an elevation of from 900 to 1200 feet above sea-level, on the side of one of our Yorkshire valleys, fully exposed to the prevailing winds, and not far from an immense reservoir formed by one of

our great municipalities. The land here is valued at 7s. 6d. per acre annual rent. There are plantations near, which are not satisfactory. But this one has been well planted, carefully tended, and judiciously and gradually thinned. It is forty-five years old, and I believe that I should be justified in making a similar offer for the crop as for the other, and am satisfied that it would leave me as a merchant a reasonable profit. I put the matter in this form in order to show that what I am saying is not simply a "pious opinion." Around this hill-plantation are hundreds of acres of land which could be planted with equal advantage, and within the immediate district, thousands of acres. The quality of the timber in both cases is very good. Many such instances of good plantations could be given, and even at higher altitudes, but I leave it to others to do so. These examples are useful because in any discussion on timber growing, generally the first objection raised is that it takes a long time for the expense to be repaid. Certainly there is in this way, both to private and public owners, a real hindrance, and it is just therein where—as is done in some other countries, and even in this to some extent—the Government could, by a wise patriotism, help to increase the wealth of the nation. For this is essentially a national question.

To-day I do not discuss forestry under private ownership, nor forestry on lands belonging to the nation, or to corporations other than municipal. But I do wish to speak about the class of lands referred to in the letter of the 18th January by the Association of Municipal Corporations to the Secretary of the Local Government Board. That is, lands owned by municipal corporations for public purposes, such as waterworks, and this too, in reference to the question of help to the unemployed, as I have had some experience therein.

One of the great reasons why corporations would be ideal forest-owners, as they are frequently in Belgium and elsewhere, is that forest schemes could be carried out on consistent principles, through long periods, uninterfered with by temporary embarrassments, death-duties, or personal fickleness. Corporations could undertake them on a large scale, and after twenty or twenty-five years have a large and regular supply of produce, which would consequently secure a regular market.

A considerable body of expert opinion is in favour of reducing or banishing agricultural operations on water-catchment areas, and this abandonment naturally reduces the rental value of the estates. The sporting rents would not be materially affected by afforestation, only the nature of the sport would be changed.

Often the catchment areas are in comparative proximity to populous tracts that require large volumes of timber, and the means of transport are often considerably improved by the requirements of the construction of the waterworks. Besides, the mechanical methods of transport are being continually improved and cheapened, and we are probably even yet far from finality in this respect. This matter of transport is of vital importance to the value of a timber crop.

There is another aspect of the question—that of the effect of forests on the collection, conservation, and purity of the water supply itself, and this I will put into a few words, as I have gone into it more in detail elsewhere. (“Transactions of the Royal English Arboricultural Society,” Vol. VI., 1905-6.)

Forests cause an immense reduction in evaporation from the ground and reservoirs, they promote percolation and filtration through the ground to impermeable strata below and consequently to the water springs, they reduce the surface-flow of the precipitated rain and increase the spring-water, and at the same time conserve the flood-water and help to let it down more gradually to the reservoirs for times of scarcity; they prevent or reduce enormous quantities of silt being carried into the reservoirs, and, lastly, the balance of evidence is in favour of the theory that they promote precipitation of moisture.

Just a few sentences as to afforestation in relation to the unemployed. If the principle is accepted that work is to be found for the willing employable, it should as far as possible be of a character remunerative to the country, or, to use the words of the letter of the Association, it should be of such a nature that it can be “carried out without much loss.” I think I have shown that in afforestation the balance of evidence is in favour of a profit when skilled experienced labour is employed, both directly by the crop and indirectly by the improved water-supply. As regards the profit to the country, surely to

make a forest of timber grow where heather grows now is at least as laudable and beneficial as "making two blades of grass grow where one grew before." It may be said, and truly, that by employing unskilled labour the cost will be greater. But even if the work is done partly by means of some of the fittest of the unemployed, the difference could be, with a clear conscience, met by Government, and there would be something more to show for the money than there is from some relief schemes. Of course, the extra cost of the unemployed should at first be calculated and written off.

Not all unemployed labour-power any more than all waste land is suitable for afforestation work. But experience has shown on the Leeds work, and probably elsewhere, that some men are suitable, and are willing to continue upon it. Afforestation is useful chiefly in winter, when there is often a shortage of outdoor work in towns, and men should be induced to return during the planting season, year after year, when once they have been trained. There is also a certain amount of work throughout summer, both in the plantations and in the nurseries, which ought to be established on all afforestation areas. Much of the rougher work, too, such as cheap road-making, draining, etc., does not require so much skill as the actual planting. But, as I pointed out in my Preliminary Report on the Leeds work (July, 1905), the great thing is to select and send out only men who are able and willing really to work properly and to the winter conditions of country labour. Anything which can be done ought to be done to instil in them a liking for country life. The men who have stuck to the work through a winter season are so much improved by it physically as to form in themselves a more valuable asset to the community.

I have studied and worked long at this question, and the more I look into it the more I am convinced that the interest in forestry which is conspicuously growing in this and in all civilised countries is an interest which has been worthily awakened. So far as this country and our great urban communities are concerned, forestry can be a means of bringing together some of the spare capital and spare labour, with advantage to the nation, by making present and future employment for the

employable, by improving the real wealth of the nation and of our municipalities, and by encouraging a return to country pursuits. It must not be looked upon as a means of settling the whole question of the unemployed, or in any other extreme view. Such a combination of labour and capital, on well-devised plans, carried out by well-supervised work, can be brought about as an extension of the Leeds experiment by the Local Government Board making annual grants on labour-account to assist the expenditure of municipalities on the other costs of afforestation. This also, especially with the co-operation of the Board of Agriculture and the Local Government Board, which this Conference indicates, will secure the movement from becoming merely a momentary, fashionable craze, and establish it on a basis which will make it a steady, consistent, and profitable national institution.

Sir JOHN ROLLESTON thought national rather than local effort should be encouraged. Of all the schemes embodying "back to the land," afforestation seemed to him to be the most promising.

Mr. HARMOOD-BANNER, M.P., speaking for the Municipal Corporations Associations, asked the Government to consider the desirability of relieving municipalities of rates on land planted with trees, so as not to throw upon the present rate-payers burdens in respect of advantages that were to accrue in the future.

Alderman BURGESS and Mr. J. PARRY gave an account of successful planting at the Liverpool Waterworks Catchment areas at Vyrnwy in Wales and Rivington, Lancashire. The letter said that the price of imported coniferous timber had during the last ten years risen by 50 per cent. at Liverpool. They are planting 300,000 trees annually at Vyrnwy, and 1,200 acres have been set apart for planting. If their trees sold at the rates recently charged for timber purchased then from Lord Powis, they would be worth £100,000 in forty-five years. At Rivington, they recently sold a crop of trees at £192 per acre, the site being required for the waterworks. Here 1,243 acres are to be planted, the average cost hitherto being £2 8s. 9d. per acre.

Mr H. J. ELWES, F.R.S. (President of the English Arboricultural Society): My Lord and Gentlemen,—I hope you will not think from anything I may say that I wish in the least degree to throw cold water on a subject upon which, I may say, I have possibly devoted a larger proportion of my means and a larger part of my time than any man in this room, but I do think when you have regard to the enormous complexity of this subject and the extreme difficulty of realising the financial aspects of what I may call, I think, without fear of being contradicted, the most distinct gambling in futures that can be imagined, I hope you will realise that this is a case in which the profits or losses of any such investments cannot be forecasted. First of all, you have to consider the nature of the soil, how infinitely it varies; how ridiculous it would be to do in Lancashire what might be the best possible practice in Kent. What these gentlemen have said about their localities is different from those I have had to do with. When I began to plant trees on a large scale twenty years ago, I had the accumulated experience of my father and grandfather and great grandfather, who were all tree planters. I had a very able local woodman. I believe local knowledge and experience are of greater importance than all the so-called scientific or expert knowledge you can get without it, because, though no one can accuse a man who is a Fellow of the Royal Society of being a scoffer at science, yet science is only knowledge, and no man's knowledge would enable him to say what to do to the best advantage in such a difficult question as planting trees in a country of which he has no practical knowledge. It is extraordinary how greatly the soil and climate change even in a very limited area, and the result of my experience has been that, having regard to the long time it takes to produce any definite result, and the great loss that one may incur if one does not plant in the right way, one should always begin in a small way and gain experience as you go. If you try to estimate what the ultimate cost will be, you must consider what you have to pay for the land. My experience has been that municipalities always and the Government generally buy land too dear. There is one notable exception, and that is when they bought Salisbury Plain. I believe that was one of the most cleverly managed

transactions our Government ever undertook. No one in his senses would buy Salisbury Plain to plant trees upon, because most of the land is unsuitable. You may in the course of a long series of years get certain trees like beech trees to grow, but what are you going to get for them when they are fit to cut?

That brings me to the second point. Sir Hugh Beevor quoted a case the other day, in discussing a paper read before the Institute of Surveyors, saying that a large area of the most magnificent beech, from a German forest point of view, that can be produced in Great Britain, were sold in Sussex. And the cost of the carriage from Sussex to High Wycombe, which is the best market for beech in Great Britain, was more than the owner of those trees had obtained for the use of his land for perhaps 150 years. Now unless you have a good market for the timber near your land, remember that the railway companies will get the first share and the merchant the second.

There is another point you have to consider. It has been very properly urged by several representatives to-day, and perhaps they can urge it with much more force than we poor landowners can do for ourselves—and that is rates and taxes. Now can you conceive any way less likely to encourage a man to plant his land than to rate it upon his own improvements? I planted something like 110 acres of land in one year. I made a mistake in doing it all at once, but, still, the man who never makes mistakes never makes anything. The land was partly my own and partly bought from the Board of Agriculture, and I can honestly say if that land ever returns me 1 per cent., I shall consider myself very well satisfied. But there is another aspect you must look at, and that, I think, was very well put by Mr. Burgess, and that is the æsthetic aspect of planting. When you plant trees for profit, you may aim at producing a forest such as a German forest. The idea of a forest in Germany is an area of land which will produce the largest number of cubic feet per acre, and which often consists of thin poles standing as thick as they can. A remark was made to me the other day by a very practical business man to this effect. He was walking round one of my woods. I said:

"I am afraid future generations will say, 'What a lot of money this old idiot wasted on planting trees.'" He replied, "Yes, some may say that, but at the same time I venture to say that if, from a business point of view, you look at the land you have planted as the owner, and consider the enjoyment you have had from it, or you look upon it as a seller, or you are in the unfortunate position of being obliged to let it, any practical surveyor will value your land to sell or to let at a higher rate than if it was covered with the most perfect German forest." That is a point of view that is not always regarded, and it should not be overlooked by the municipalities. No doubt there are a small number who would like to see a perfect forest from a sylvicultural point of view, yet there are thousands of inhabitants to be considered, and the ratepayers who put the corporations in the position of managing their affairs in the best interests of the town want the same sort of woods to walk about in and enjoy themselves in as an English land-owner, who, though it is the fashion to look at him as the enemy of mankind, is yet the only person to whom you can go to show you the financial results of planting, which are rarely as good as they are made out to be. Dr. Schlich quoted my district, but I should be very sorry for anyone to go away imagining that those quite problematical results, which I put before him with the object of knowing what they would work out at, are ever going to be realised; because I doubt it. I have read through many hundreds of pages of evidence taken before various Agricultural Commissions, and before various Forestry Commissions in England, and I have only found one single case of a large landed estate where the accounts have been sufficiently well kept for a series of years to be able to show a definite profit per acre realised from the woodlands after making reasonable and fair allowance for outgoings, and that was Lord Yarborough's property in Lincolnshire. Now I dissent generally from what Sir John Rolleston said in regard to its not paying to plant land worth more than 10s. an acre. I myself, looking upon trees as a gardener looks upon plants, would prefer to plant the best land I could spare or buy. I believe if you were to calculate the eventual returns, you would find that the most profitable planting is that which is carried out on the

best land. I don't mean the best land from a strictly agricultural point of view, because you must remember that the roots of trees reach to a very much greater depth than the roots of agricultural crops. But before you plant land you ought to know what the sub-soil is as well as the surface. You very often find land which is too steep or too dry or too sticky on the surface to be profitable agricultural land, but you may find that it contains valuable chemical elements in the rock below which the roots of the tree can reach, and which make it much more valuable if planted, than for agriculture; while on the other hand you will see some of the best barley and wheat land that no experienced man would think of planting trees on, with any expectation of making a profit. Most of the land which is considered as waste land is either mountain land or land covered with heather, and there is no doubt it is much easier to plant heather land than to plant land that is covered with grass. I think Mr. Parry told us the average cost of their planting has been about £2 10s. per acre. Now I had to let a contract for planting three or four years ago, and I had holes dug in several fields, and brought a man who had done a great deal of contract planting, and I asked him to make a careful estimate on the understanding that he was bound to make good all the deaths not caused by fire or game at the expiration of two years, and he put the price at, I think, £6 5s. an acre. I said, "Supposing you do it by notching instead of pitting, what would you charge?" He said, "I could not make a reduction of more than 15s. per acre, because if you try to plant in that way, your proportion of deaths may be 70 per cent. or 80 per cent. in a dry summer, but with pit-planting I should hope not to have more than 15 per cent. of deaths." Nature is in this case very often stronger than man. We had a frost in May, 1905, which destroyed eventually—though many of the trees did not die for two years—a large proportion of the trees, and I do not think there is now 10 per cent. of the beeches he planted left.

Another important point is the question of labour. Now, nobody would be more gratified than I if I could see a fair chance of employing the unemployed at this sort of work. But one speaker very properly said, "You don't want a great many

men, but you want them at a particular season, and mostly at a season when outdoor work is unpleasant, namely, in November and December." Now you won't get a man who has been used to working in towns to do what is really very laborious work on a bare hill-side in winter ; or if he tries it, he won't go on doing it long. If he was willing to do that sort of work, he would never be unemployed for long. The sort of fellow who comes for a job is often a man who wouldn't work if he could, and couldn't work if he would. If you employed them at the time you want them, to dig holes, what are you going to do with them afterwards? You can't turn them off in the dead of winter. You have, as Alderman Burgess says, either to employ uneconomical labour or to have a regular staff of men who will do their work properly as skilled work, which it really is. I have planted—or helped to plant—with my own hands—well, I should not like to say 100,000 trees, but I don't think it would be exaggerating if I said half that number, and I can say honestly every day I learn something. I look upon it as an operation requiring enormous patience, a good deal of capital, time, and local experience. Now, experts are very good advisers when they know ; but there is no people so liable to be imposed upon by so-called experts as municipalities composed of gentlemen who have not a great deal of country knowledge ; and they do get imposed upon sometimes. There is one of the most empty gas-bags I know of going about at the present time taking money and posing as an expert on forestry. I have read advice of his which is really frightful nonsense. If a man like that knows how to talk he very often has a great deal of work to do, and it is very hard for people who rely on him. You wouldn't allow a man to come into a factory or a mill and advise you to renew the whole of your machinery without being sure that he knew something about it. Although I believe we are going to see timber a great deal dearer, it is not the sort of timber you will usually grow on waste land. We can grow some of the highest quality timber in England, but not on waste land or on very high land, and the sort of timber we shall be able to grow on land of that description, so far as my experience goes, cannot be put into competition with foreign timber.

Mr. STAFFORD HOWARD, Commissioner of Woods and Forests, agreed with Mr. Burns as to the desirability of taking in hand a large area at a time for purposes of afforestation, and said that where they had large forest areas they had proved a great encouragement to small holdings. He did not believe that afforestation would be a real solution of the unemployed problem. He thought that three things might be done in regard to profitable forestry. The first and most important was to make our existing woods more profitable, and manage them with greater skill; secondly, he thought that a great deal was being done, and could still be done, to encourage municipalities to make experiments in this direction; and in the third place, more might be done by the State in regard to the planting of trees.

Alderman Sir BOSDEN LEECH (Manchester) stated that Manchester intended planting its water-catchment areas of 19,000 acres, regularly, year by year, till all available land is planted.

Councillor OGDEN (Chairman of the Leeds Waterworks Committee) said in his mind there remained considerable doubt as to whether, even under the best conditions, there would be any profit on the afforestation, and if there were associated with the scheme a necessity of finding employment for the unemployed, all chances of profit would absolutely disappear. (Hear, hear.) The paucity of information at present available made it desirable that careful statistics regarding the commercial aspects of forestry, based on British experience, should be obtained and published by the Board of Agriculture. He was satisfied that the sympathy expressed by the President of the Local Government Board would enable the municipalities to attack the problem with greater hope in the future.

Councillor THOMAS SHAW (Sheffield) and Mr. G. T. LEE (Town Clerk of Derby) urged that corporations should be relieved of taxation on lands being afforested, and otherwise assisted by the State.

Councillor JOHNSON (Bradford) suggested that the Government should make grants and advance loans free of interest for a long period of years.

Mr. SCOTT PLUMER, of the Royal Scottish Arboricultural

Society suggested State agency for afforestation in Scotland, where there is much land that owners could sell cheaply, and a good deal of which might be extremely profitable for forestry. This land, at present, employs one man to about 1,000 acres. If planted, it would employ ten. Planting should, however, be done by skilled labour only.

Mr. Lees (Birmingham), also took part in the discussion.

Mr. A. C. FORBES (Adviser in Forestry to the Irish Agricultural Department) said that much of the work connected with afforestation requires little skill, and can be done by men having no previous experience, provided they were willing to receive instruction from a skilled man. One of the difficulties is the acquisition of suitable land near large industrial centres, which can be reached by town workmen in the morning and from which they can return at night. The land around most industrial centres is either too valuable, or too closely occupied already to be available. If the land to be planted is distant, temporary huts may be erected, in which the men can be housed and fed, but this entails a heavy expenditure. In theory, the unemployed workman is one suffering privation through his temporary inability to obtain regular work and is anxious to accept any honest work offered until he can resume his regular employment. In practice, it has been found that many of the nominally unemployed are casual labourers not anxious to accept work that involves a little personal inconvenience, or who carry on the work so carelessly that their services have to be dispensed with in the interests of discipline and order.

The great objection to afforestation being done by the unemployed is that it is impossible to carry it out successfully by spasmodic methods of procedure. The annual work to be done in any good scheme of afforestation must be calculated several months ahead, so that opportunities for employing a number of men, at a few weeks' notice, are confined to the work preparatory to planting, and unless this bears some relation to the planting, money and labour are wasted. To regard afforestation work as one that can be alternately stopped and resumed is a serious mistake, involves waste of money and more or less of failure. The

wages (5*d.* an hour in the Leeds experiment) might not tempt young men to adopt country life, but to middle-aged men the glamour of town life offers few attractions. Planting requires care and skill, and a middle-aged man would as quickly become proficient in it as a younger, stronger, but morally weaker individual.

Permanent employment would solve the difficulties of distance and temporary housing, and still the difference between the employment of twenty men for one year and one hundred men for two months means a saving for the rate-payers in the former case, and touches only the fringe of the question in the latter. The most urgent work at present appears to be that of ascertaining not only what land is suitable, but also how much is available by purchase at £5 or so, per acre. Much land valued at £1 and £2 per acre is quite unsuitable for planting.

LORD CARRINGTON, in bringing the proceedings to a close, expressed the hope that some practical good would come of the Conference. Landlords, he thought, could do a great deal to improve their estates by planting trees, and the Settled Estates Act enables tenants for life to raise money out of the estate, so as to improve it by planting, and he hoped that something would be done in that direction by individual landowners, as well as by municipalities and government.

In the evening a banquet was given by the Carpenters' Company to members who attended the meeting, after which speeches favouring the scheme were made by Lord Carrington, the Master of the Company, Sir Herbert Maxwell, and Mr. Munro Ferguson, M.P. Lord Carrington said that the Conference had knocked on the head the delusion that afforestation was a great cure for want of employment. He also thanked the Company most cordially for their hospitality and for the generous help they had accorded to forestry, by offering prizes for essays, and in their sympathy with the subject.





3 2044 102 800 653



